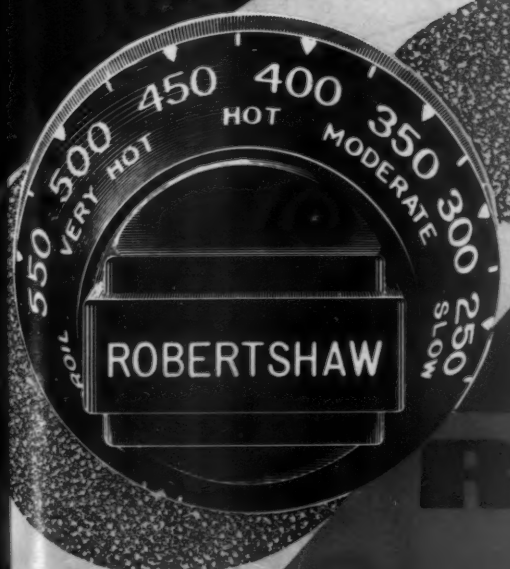
AMERICAN GAS JOURNAL

OCTOBER, 1936

SPOTLIGHT

YOUR GAS RANGES AS MODERN!



Play up

ROBERTSHAW

OVEN-HEAT-CONTROL

Shine in the floodlight of modern gas range publicity turned on by the American Gas Association. . . . Prove to customers that the ranges you sell are modern by showing that they are Robertshaw equipped. . . . Point out that this dial brings perfect control of oven temperature — brings new savings by reducing shrinkage of food and waste of fuel, while retaining food flavors. . . . It will pay you to play up the Robertshaw dial. It is the mark of the modern gas range. It packs the selling punch of a product advertised to women for over 16 years.

ROBERTSHAW THERMOSTAT COMPANY, YOUNGWOOD, PENNA.

OVER 2,600,000 IN USE

ROBERTSHAW

OVEN-HEAT-CONTROL

COMPOSITE VIEW OF THE MOST MODERN AND BEST EQUIPPED METER, REGULATOR, AND VALVE FACTORIES IN THE WORLD

PROUD TO SERVE A GREAT INDUSTRY

The confidence placed by the Gas Industry in our organization, since its founding half a century ago, not only makes us justly proud but also imposes the safeguarding of a valued reputation. The constant adherence to a rigid set of business principles has been largely responsible for our success.

We feel that the continued support of the Industry can be merited only by the consistent maintenance of the

PITTSBURGH EQUITABLE CREED

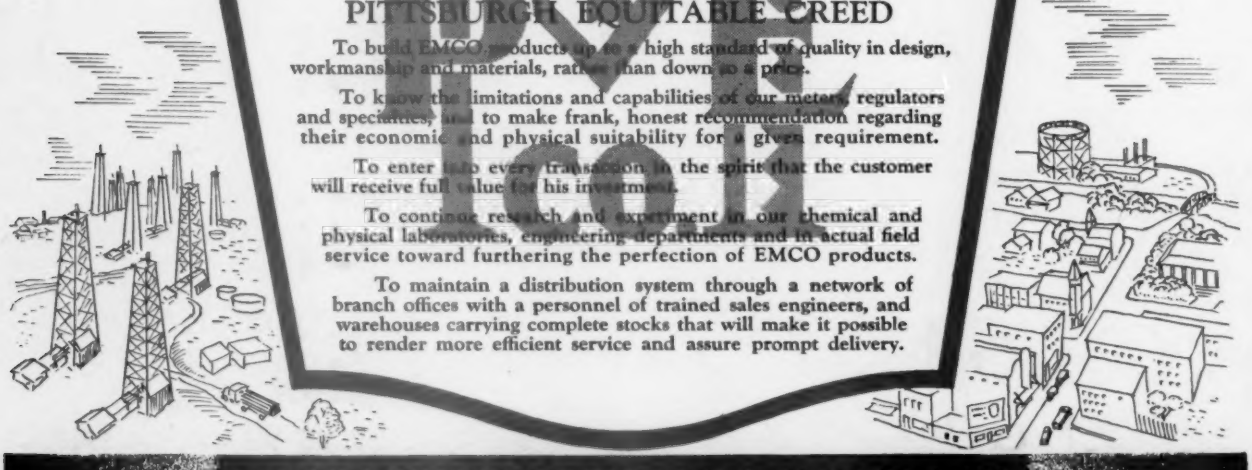
To build EMCO products up to a high standard of quality in design, workmanship and materials, rather than down to a price.

To know the limitations and capabilities of our meters, regulators and specialties, and to make frank, honest recommendation regarding their economic and physical suitability for a given requirement.

To enter into every transaction in the spirit that the customer will receive full value for his investment.

To continue research and experiment in our chemical and physical laboratories, engineering departments and in actual field service toward furthering the perfection of EMCO products.

To maintain a distribution system through a network of branch offices with a personnel of trained sales engineers, and warehouses carrying complete stocks that will make it possible to render more efficient service and assure prompt delivery.



PITTSBURGH EQUITABLE METER CO.

MERCO NORDSTROM VALVE CO.

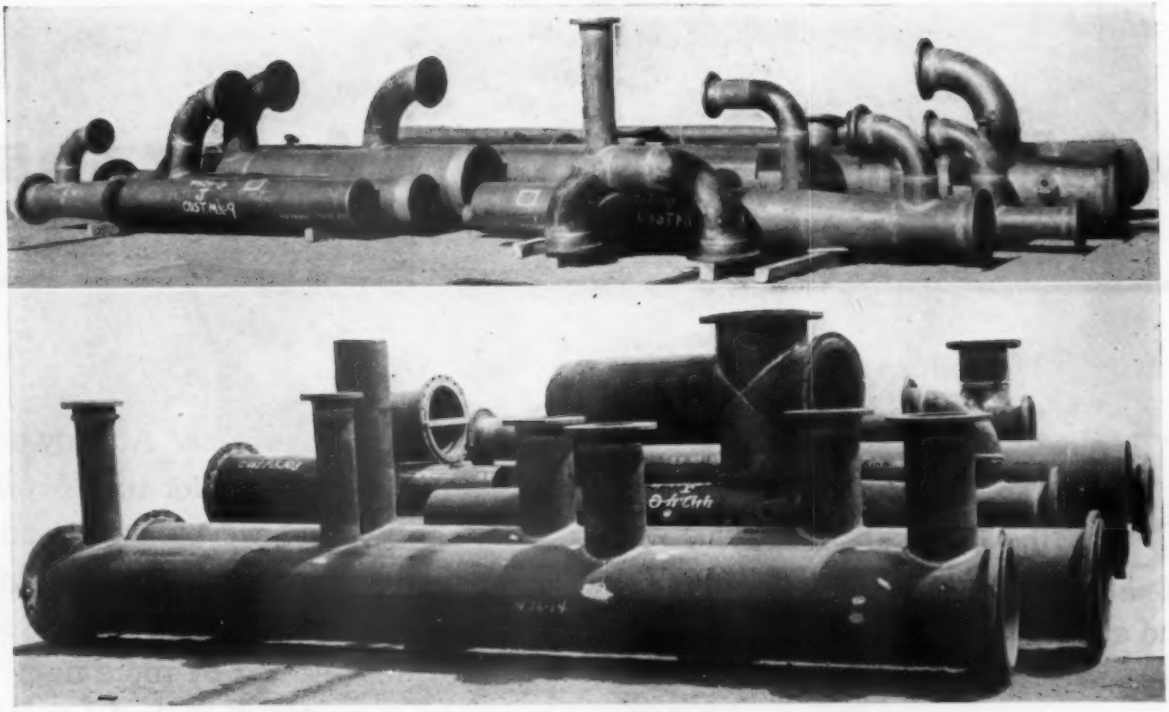
MAIN OFFICES PITTSBURGH, PA.

NEW YORK · LOS ANGELES · TULSA · HOUSTON · MEMPHIS · BUFFALO

COLUMBIA · KANSAS CITY · CHICAGO · PHILADELPHIA · ATLANTA · OAKLAND

AMERICAN GAS JOURNAL, October, 1936. Vol. 145, No. 4. Published monthly by American Gas Journal, Inc., at 34 North Crystal St., East Stroudsburg, Pa. Executive and Editorial offices at 53 East Park Place, New York, N. Y. Entered as second-class matter, October 7, 1928, at the post office at East Stroudsburg, Pa., under the Act of March 3, 1879.

HIGH PRESSURE PIPING



These unretouched photographs, taken at our shops, show a shipment of Semet-Solvay welded pipe and fittings made for the handling of natural gas under high pressure.

Welding was done according to the 1935 A. S. M. E. specifications for high pressure service. The job passed every exacting test and inspection with plenty to spare.

Come to Semet-Solvay with your plant and processing problems. We are unusually well qualified to serve your needs for equipment that will give improved results from your processes and for working out economies in operation.

SEMET-SOLVAY
ENGINEERING CORPORATION

Engineers *Contractors*

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with a new unity of purpose

SINCE the days of the first struggling "gas light" companies, the history of the Gas Industry has reflected a cooperation and a free exchange of ideas on technical matters that might well serve as a model for other industries. The resulting improvement in production, distribution, and utilization has made gas one of the most dependable, economical and versatile of utility services.

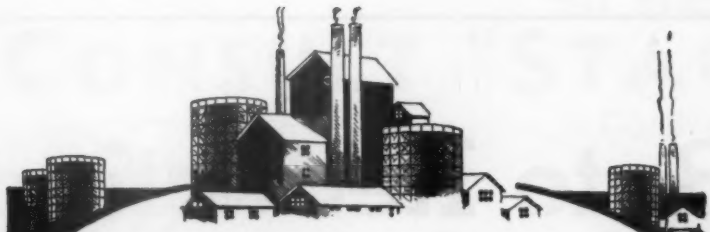
Within the past twelve months the industry has come together with a new unity of purpose to bring this same kind of intelligent cooperation to a field where it is more urgently needed than ever before. For more than 10 months a widespread cooperative radio feature has been creating a new interest in gas cooking in the kitchens of America. Already some half a million requests for the "Mystery Chef" cookbook have been received by more than 130 gas companies now sponsoring this program. More recently, the industry, represented by more than 700 gas companies, has launched one of the most extensive and impressive advertising campaigns ever undertaken by a cooperating group—the three-year "Modernize Your Home with Gas" campaign now appearing in national magazines of some 14,000,000 circulation.

This organization is proud of its share in the industry's cooperative efforts in the past. It is equally proud of its active participation in the present undertaking—to give the public a better understanding of our product and our services.

AFFILIATED COMPANIES OF

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.

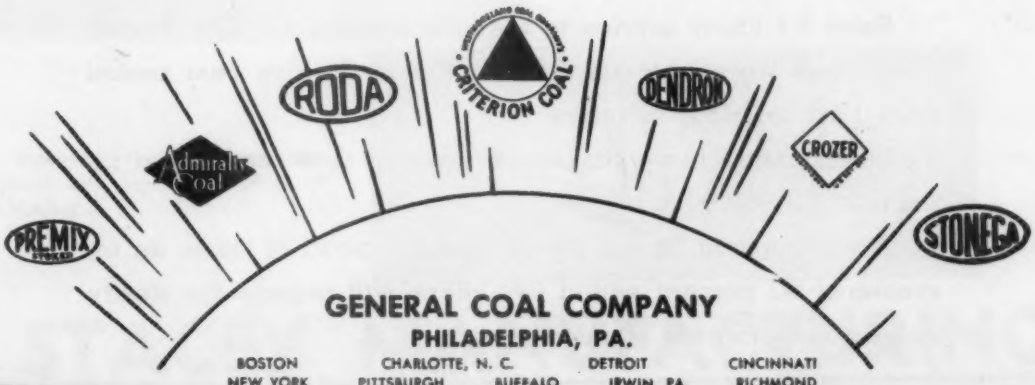
ELECTRIC, GAS AND STEAM SERVICE FOR BUSINESS AND THE HOME



A General Coal Message ...of General Importance to the Industry

The increased usage of General Coals is the result of the increased value of gas, coke and other conversion products. You are invited to satisfy yourself as to the economy of General Coals on a basis of actual operating results.

■



GENERAL COAL COMPANY
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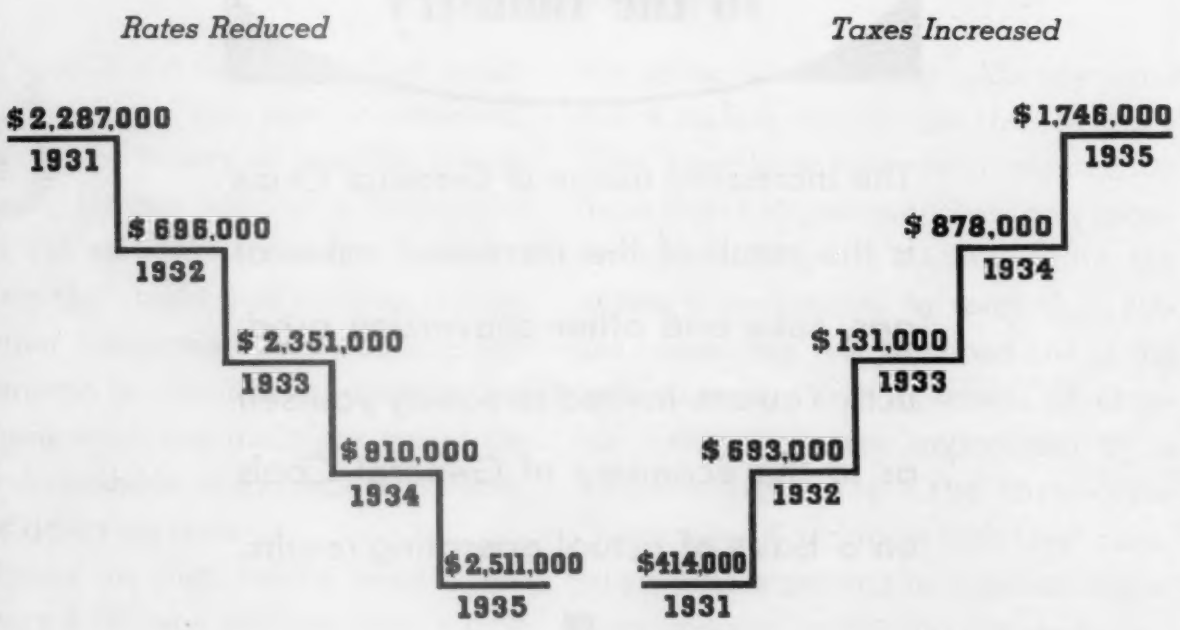
BOSTON NEW YORK CHARLOTTE, N. C. PITTSBURGH DETROIT BUFFALO CINCINNATI IRWIN, PA. RICHMOND

GENERAL COAL COMPANY

GENERAL COAL

Rate Reductions or Taxes



Rates for utility service to the customers of U. G. I. System Companies were reduced $8,755,000 in the five year period from 1931 to 1935, inclusive.

In that same five-year period taxes of those companies increased $3,862,000.

A continuation of this steady *upward* trend of taxes, an increase of 50 percent within five years, will impede the steady *downward* progress of rates.

THE UNITED GAS IMPROVEMENT COMPANY

1882 *The Oldest Public Utility Holding Company in U. S. A.* 1936

THE ORIGINAL

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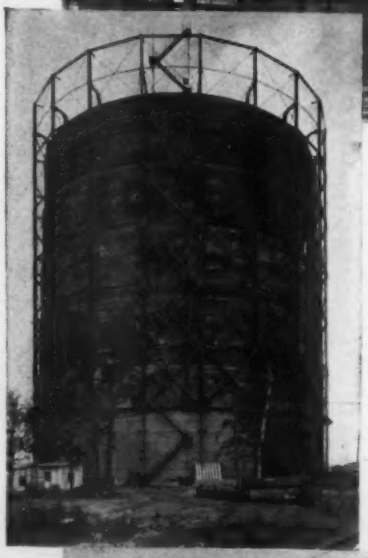
ABOUT

GAS HOLDERS

STEEL PLATE CONSTRUCTION

GAS HOLDER INSPECTION

STACEY SINCE 1851



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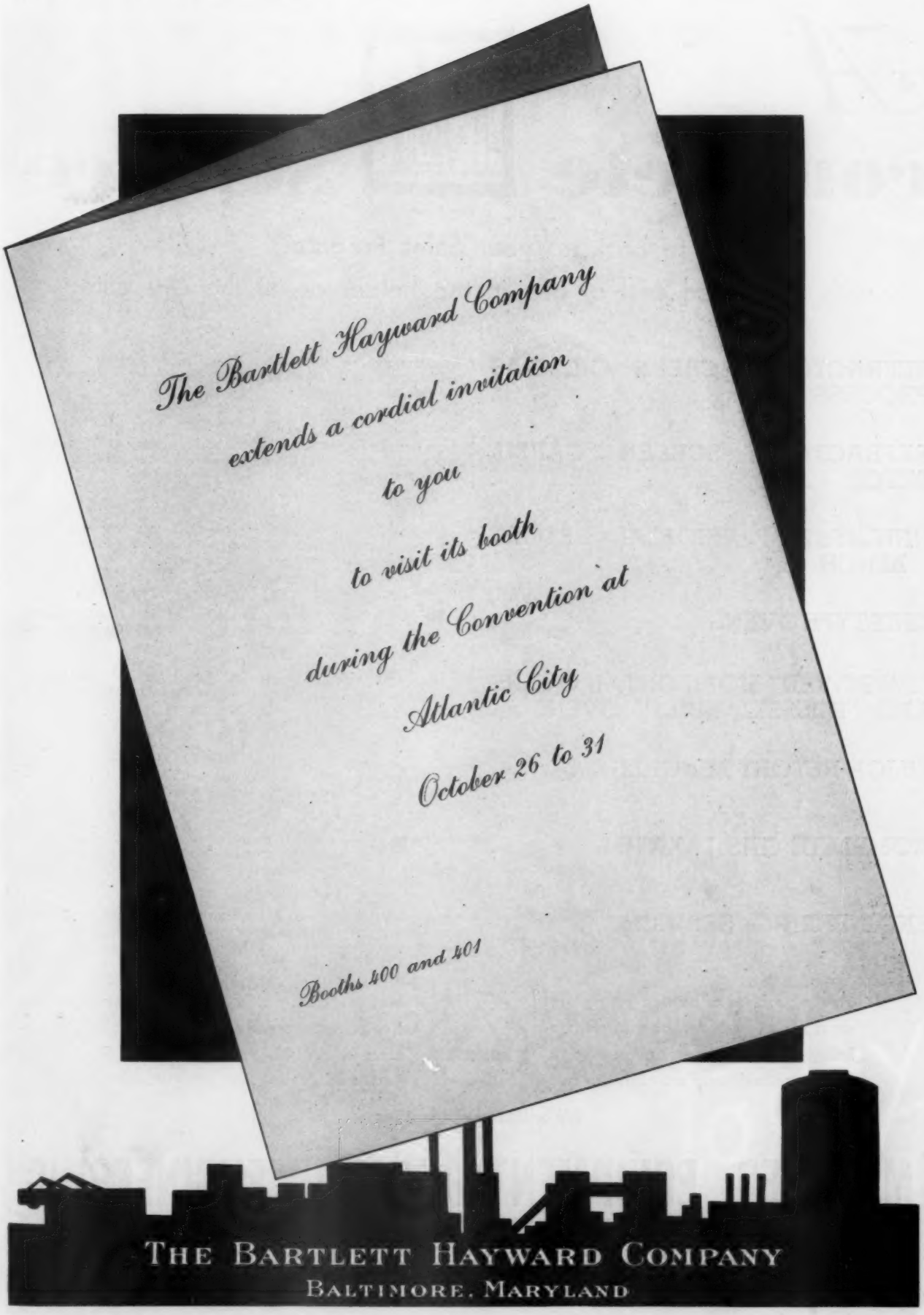
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October 26 to 31
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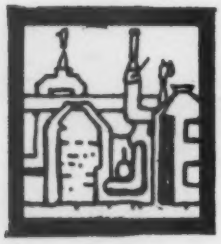
A complete  service

to back up your Sales Program
with decreased cost of gas—in the holder or, at the city gate

REFRACTORY SCREEN OIL GAS PROCESS . . . . . An economic answer to the need for a high BTU gas for stand-by or peak load purposes in all natural gas situations. Utilizes existing water gas equipment.

REFRACTORY SCREEN CARBURETOR . . . . . A process utilizing low cost high carbon oils successfully in combination with coal or coke for carburetted water gas production, taking advantage of fuel market price fluctuations.

UNIT-SYSTEM VERTICAL RETORT BENCH . . . . . A new method for the production of coal gas and mixed gas variations. Featuring unusual flexibility and peak load provisions. Low investment cost and low operating cost.

UNIT TYPE OVENS . . . . . For the smaller plants, these ovens offer efficiency and economy of operation, moderate initial cost and low cost additional capacity.

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COMPLETE GAS PLANTS . . . . Plants of any size—for coal gas, oil gas and mixed gas production, designed to meet the special economic and operating requirements for any specific situation.

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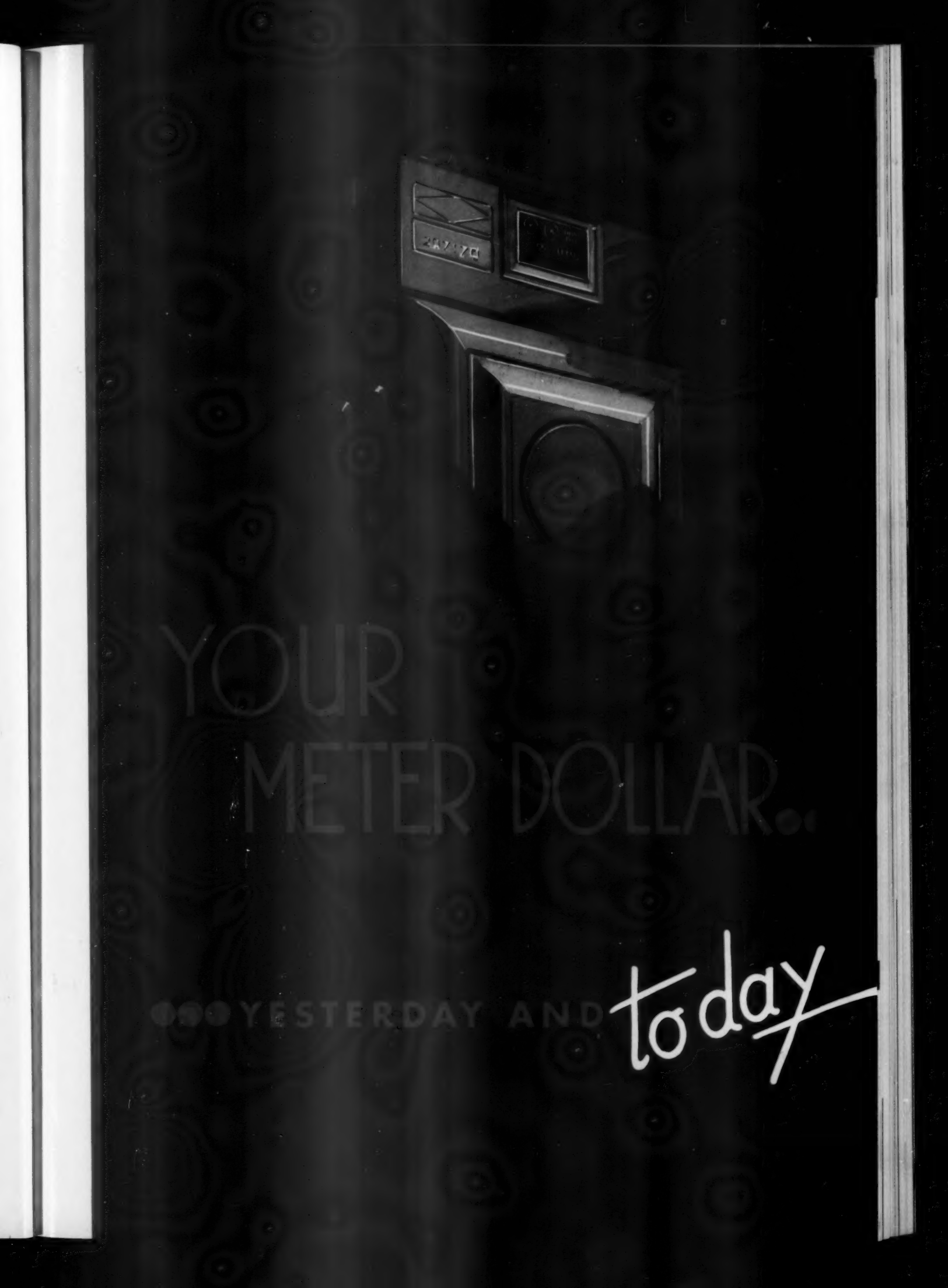
Engineers — *Division of* — Builders

Combustion Utilities Corporation

24 STATE STREET **NEW YORK, N. Y.**


YOUR
METER DOLLAR...
YESTERDAY AND today

Yesterday

METER IMPROVEMENT

AMERICAN METER CO
MEASUREMENT ENGINEERS
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1836-1936

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NO LESS STRIKING IS THE STEADY ADVANCE IN THE ACCURACY of gas measurement . . . And the developments in design, materials and manufacturing processes which progressively have reduced meter costs per m.c.f.

Your close contact with American Meter laboratories will reveal the strides which research has made in scientific knowledge of gas measurement. Its practical applications are recorded in American Meter Company technical literature.

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Measurement and control of Gas, Oil, Steam, Air and Liquid

ALBANY BALTIMORE BIRMINGHAM BOSTON CHICAGO DALLAS
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PITTSBURGH SAN FRANCISCO TULSA

CENTURY of GAS MEASUREMENT

AMERICAN METER CO. MEASUREMENT ENGINEERS
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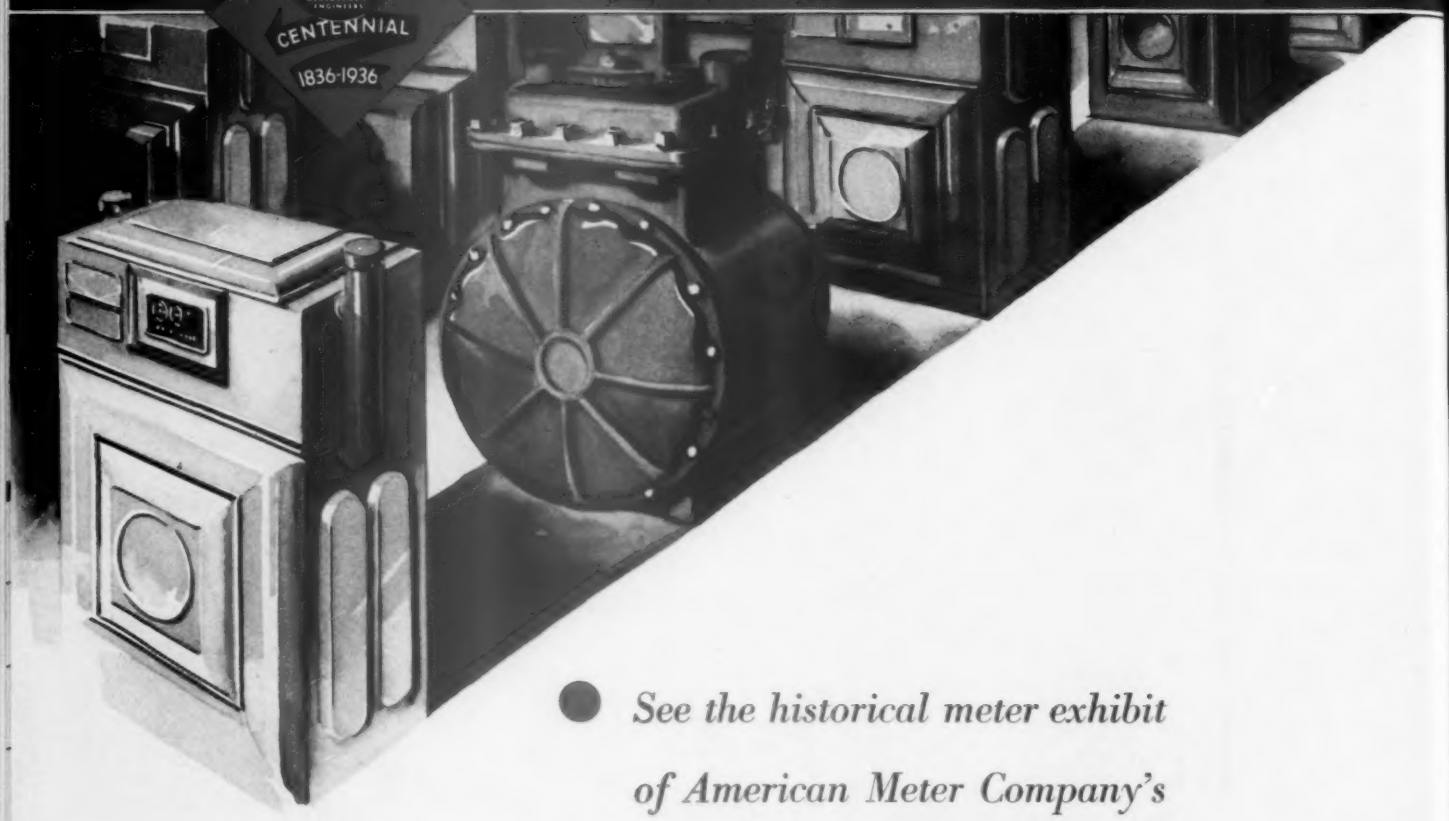

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TINNED STEELCASE METERS

and

IRONCASE METERS

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Measurement and control of Gas, Oil, Steam, Air and Liquids

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modern carbonizing systems

glover-west continuous verticals

The logical plant where maximum gas yield and coke of high reactivity are required.

The high thermal efficiency, low operating cost, extreme flexibility to meet variations in daily output, and freedom from naphthalene in finished gas have made this process the choice of experienced operators all over the world.

The proven reliability of Glover-West continuous verticals makes their adoption well worthy of consideration in any scheme of planning for the future.

●

westvertical semi-intermittent verticals

A modification of the continuous vertical which has been developed for those plants where a denser, stronger coke is of primary importance.

This process retains the time-tested advantages of continuous carbonization in vertical retorts, such as low capital cost, high thermal yield and efficiency, cool coke discharge, enclosed coal charging, and combines with them the best features of carbonization of a static charge.

●

We place at your disposal the experience gained in almost 400 installations now operating in all countries of the world and under widely varying conditions.

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"THERE'S YOUR ANSWER— INSTALL MAGIC CHEF"
MAGIC CHEF FOR MODERN GAS COOKING SERVICE
Gas · The Ideal Fuel ·
MAGIC CHEF USER
FOOD SERVICE EXECUTIVE

MAGIC CHEF
AUTOMATIC
HEAVY DUTY
EQUIPMENT

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Red Wheel Lorain Oven Regulator
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Automatic Top Burner Lighters
Automatic Safety Oven Pilot
Magic Chef Non-Clog Burners
Full Heavy Insulation
Gas Economy
Greater Speed
Greater Efficiency
Simplest to Operate
Easiest to Clean
Durability

COMPLETE AND FLEXIBLE LINE OF RANGES, BROILERS, ROASTERS, BAKERS

The Complete Answer to Today's Cooking Requirements

● When food service organizations of such national prominence as Fred Harvey; Marshall Field; Ritz-Carlton Hotel, Boston; Strawbridge & Clothier, Philadelphia; Buffalo General Hospital; Myron Green, Kansas City; and the Maramor, Columbus, install Magic Chef Heavy Duty Equipment, the perplexed hotel, restaurant or institution manager has the answer to his question "How can I improve my cooking service and reduce my costs?" Such endorsement answers the food service executive everywhere who wants to know what equipment will enable him to meet today's exacting demands for speed, dependable performance, convenience and economy.

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Magic Chef
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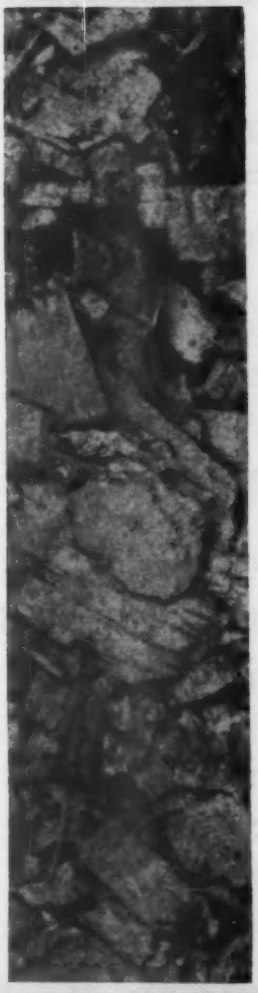
LOOK FOR THE RED WHEEL WHEN YOU BUY A MAGIC CHEF

A TIME-TESTED GAS PURIFYING MEDIUM

LAVINO "ACTIVATED" OXIDE



Supplied in unmixed form . . . ready for mixing with your own carrier . . . LAVINO "ACTIVATED" OXIDE is readily adaptable to the needs of your plant, no matter what its size or requirements.

Not merely a "satisfactory purifying medium" because of incidental properties, it is a material made specifically for maximum H^2S removal. As such, its practical capacity and activity are controlled factors . . . uniformly efficient performance is a certainty.

Tested by actual use in the field . . . evaluated on the basis of efficient, long-lived performance . . . LAVINO "ACTIVATED" OXIDE has an unusual record of *proven* results for many leading gas companies. This service data is available to you upon request. May we forward it?

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CHICAGO PITTSBURGH

AT THE CONVENTION—STOP IN AT BOOTH 611

We're looking forward to having you as our guest at our booth. We can promise you an interesting, informative and pleasant visit—we hope you'll make it a point to stop in.

● Illustration shows Lavino "Activated" Oxide as coated on tough, hardwood shavings—a form in which it is supplied, if you so desire.

FOR ALL PLANT SIZES

JOURNAL

Gas Flow Computers
High or Low Pressure

New Improved Gas Flow Computers (Either High or Low Pressure) Are Now Available in Durable Celluloid, Encased in a Convenient Leatherette Cover.

Low Pressure Computer Range:

Cu. Ft. of Gas Per Hour—10 to 500 M
Pipe Diameter ¾" to 48" (including standard and actual weight up to 4")
Pressure Loss Inches .01-10.
Length of Pipe—Feet 30-30,000
Specific Gravity 1.5-.35
Constants 1400-1000

High Pressure Computer Range:

Cu. Ft. of Gas Per Hour—100-10,000 M
Diameter of Pipe Inches ¾-30
Difference in Absolute Pressure—Lbs. per sq. in. 1-500
Sum of Absolute Pressures—Lbs. per sq. in. 2000-20
Specific Gravity 1.5-.35
Length of Pipe—Feet 100-5000
Length of Pipe—Miles 1-250

PRICE $3.50 Each

SIZE 6½" x 8"

AMERICAN GAS JOURNAL

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REYNOLDS

REGULATOR

For Every Gas Control Requirement

☆ For more than 40 years, Reynolds Gas Regulators have deen developed, designed, built and tested to meet the constantly changing needs of the industry.

That is why today the name "REYNOLDS" means absolute dependability to leaders in gas engineering everywhere. They know that Reynolds has not only been there from the start, but has kept pace with the industry's requirements.

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RECOGNIZED GAS CONTROL SINCE 1892

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Cost Reducing

UGI

MAXIMUM RETURN
TO CLIENTS PER
DOLLAR EXPENDED

UGI VERTICAL OVENS

LARGE GAS CAPACITY . .
Per Ton of Coke Produced

LOW CONVERSION COST . .
Per M.C.F. Gas Produced

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UNITED ENGINEERS
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U.G.I. WASTE HEAT BOILER

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U.G.I. HEAVY OIL PROCESS

Division of

& CONSTRUCTORS INC.

CHICAGO • NEW YORK

Newly styled by
WILBUR
HENRY
ADAMS

Announcing NIAGARA Two-Twenty

GAS-FIRED WINTER AIR CONDITIONING UNIT

The competence of this unit to fulfill the expectations of gas company executives is founded upon definite features already accorded respectable recognition among alert merchandisers of gas for residential heating.

The purpose of this message is merely to identify certain features so that you may easily acquire complete information and establish standards for intelligent comparison.

1. A central combustion chamber providing a means for regulating and proportioning the amount of gas consumed to requirements. 2. Thermo-syphon and counter-flow system of heat extraction and distribution, transferring a greater volume of heat to warm circulating air. 3. Twin blower automatically switching between normal winter speed, low speed, and shut-off; and, with an exclusive summer-winter switch which permits use of maximum summer blower operation at any time—summer or winter. 4. Central mechanism remarkable in the range of its automatic operation.

It is these features which so strikingly distinguish the Niagara Two-Twenty.

The attractive appearance and substantiated efficiency of this unit are certain to contribute generously to building good volume and good will for the gas industry. Examine, inspect and analyze the Niagara Two-Twenty at exhibition at Atlantic City or write direct for complete presentation in four parts.

EXHIBITED at the Exhibition of Gas Appliances and Equipment October 25th-30th, Booth Nos. 207 and 208, Atlantic City Auditorium.

—W. L. Seelbach, *Secretary-Treasurer*

THE FOREST CITY FOUNDRIES COMPANY
Cleveland, Ohio

OCT 26 1936

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VOLUME 145, NUMBER 4

AMERICAN GAS JOURNAL

WHOLE NUMBER 3754

Established 1859

OCTOBER, 1936

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PUBLISHED MONTHLY BY
AMERICAN GAS JOURNAL, Inc.
53 Park Place, New York

S. G. KRAKE, *Publisher*
A. M. GLEASON, *Secretary*
A. I. PHILLIPS, *Editorial Director*

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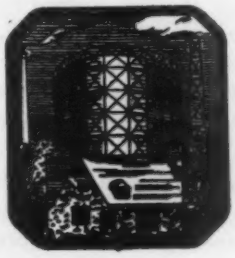

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HOW KANSAS CITY POWER & LIGHT COMPANY CUTS BAD DEBT LOSSES TO

8/100ths of one percent

One clerk can handle detail on more than 30,000 accounts—posting, proving, changing, balancing, passing all credits, serving as an information source.

KEEPING bad debt losses down to 8/100 of one percent is worthwhile for any utility! Yet the Kansas City Power & Light Company does it . . . and averages only one collector for every twenty-four thousand accounts (including active, inactive and merchandise collections as well as non-payment cutoffs).

Admittedly one of the important factors in this fine showing is their Remington Rand Customer History Record. This unique record takes all the facts about each customer from several different sources and puts them on one visible card. By an exclusive system (which groups similar sounding names), finding and reference time is cut 50% to 60% . . . errors reduced to a minimum.

With the help of the Customer History Record you can have complete information on any customer in *fifteen seconds*. Collection expense is reduced at least 50% because this record tells you definitely which accounts need collection effort . . . and which do not. In addition wherever the Customer History Record has been installed, it has brought to light large amounts of previous bad debt losses which could be either transferred to current accounts or liquidated through the application of unclaimed or inactive deposits. Frequently this recovery alone equals the total cost of installing the complete record.

A genuine help in keeping customers happy, too

Find out today what this Customer History Record could do to improve public relations and bring increased savings for your company. Trained supervisors see to it that installation does not upset the routine of any department. Phone your Remington Rand office or mail the coupon for complete story in interesting new visual form.

OK.. it's from **Remington Rand**

Remington Rand Inc., Public Utility Dept. U-410
465 Washington Street, Buffalo, N. Y.

I would be interested in seeing your new visual presentation showing what the Customer History Record is doing for other utilities.

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Company Name.....

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City..... State.....

OCTOBER
1936

AMERICAN GAS JOURNAL

VOLUME 145
No. 4

Gas in the Economic Scheme of the Future

By Thomas N. McCarter

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I have an abiding faith in the future of gas as an industry that has been erected upon a foundation of great natural resources. I believe also that gas will occupy an even more important role in the everyday life of the coming generation, than it does at present and that the industry itself will grow in stature and influence.

Nor am I doubtful as to the immediate outlook for gas. It is true that certain factors, notably the depression and increased competition from electricity and other fuels, have affected sales adversely in the recent past, and it is true also that future competition may be even more acute, but there is no reason for lack of confidence in the future of this indispensable fuel. Some readjustments may be necessary, but the industry is so fundamentally sound that it should be able to successfully withstand all the assaults that may be made upon it, and from whatever direction.

If we are willing to analyze the present conditions of the industry, we can arrive at only one conclusion: That gas not only will continue to occupy its important role in the national economic scheme, but should be able to largely increase its sphere of public usefulness. The depression has gone, and we may look for a further resumption of industrial activity. Healthful competition need never be feared, and, in my opinion, there is no reason why the competition of gas and electricity should not insure the survival of both, each fulfilling its destined role in the national life.

Some of us are too prone to over-emphasize the competition that gas must meet from electricity. While it is true that competition from this source has been growing, it has not been, speaking out of our own experience, the chief reason for lack of a larger growth in gas consumption. This has been the result of various causes. We must remember that when comparisons are made between gas and electricity, there are certain intangibles that should be taken into consideration, but seldom are. There is, for example, the universality of electricity. Some sections have no gas facilities at all, but there is scarcely a locality in the entire country where electricity is not available, a condition that naturally affects the reliability of comparative statistics. Take our own company, for example. Selling both gas and electricity, our per capita consumer consumption of electricity is approximately 600 kwh's per annum, whereas in regions where gas is not obtainable at all the per capita consumption may reach a figure of 1,000 or 1,200 kwh's a year.

It has always been my belief that gas and electricity have their own particular spheres, and that is why our company has never attempted to promote one at the expense of the other. If we advise the use of either fuel, it is because we conscientiously believe that the one recommended is better adapted to the requirements of a particular customer.

There is no need for anxiety as to the future of the gas industry, even under the most rigorous of competitive conditions; that is, if the industry itself is alive to its own opportunities and responsibilities which I believe it is. Gas companies to be successful must be intelligently aggressive, show reasonable ability to adapt themselves to changing conditions, take advantage of all technical developments that promise to contribute to increased efficiency and economy, and build up competent, honest, and loyal organizations.

For myself, I am firmly convinced that gas has an enormous potential field, especially in the realm of cooking in which this fuel has not at present nor may ever have comparable competition, for no heat agent is more efficient, more economical, or has such flexibility of control.

Cooking in the home has been decreasing in recent years chiefly because of the change in the habits of the people as a whole. We have had the fads of diet, and, the ever increasing canned-food invasion of the kitchen. More recently too, we have had the new threat of partially cooked foods, spelling necessarily lowered gas consumption. In-

creased efficiency in the building of ranges has also been a factor in lowering the consumption of gas.

But, with all these adverse factors considered, there is no reason, in my opinion, for discouragement, if we set ourselves resolutely to the task of not only regaining the business we have lost, but materially increasing our production and sales. This will require vision, energy, patience, and an infinite amount of hard work, but it can be done, of that I am convinced.

One of the chief, and perhaps the most promising method of increasing gas sales would seem to be through stressing home economics, particularly in increasing the housewife's interest in baking. It will never be possible to restore home bread-baking to its former status, but through intelligent methods of education millions of women can be induced to make their own cakes, pies, and pastries.

In the field of household refrigeration gas also has a future of promise, for in this sphere it can do anything that electricity or any other fuel can accomplish, although under existing conditions it cannot hope to sell as many units as the electric industry in this particular branch of service because so many more firms are producing and promoting the sale of electric refrigerators. This is strikingly demonstrated by the published statement that the advertising devoted to the promotion of electrical refrigerators last year was over a thousand per cent higher than that used in selling refrigerators using gas.

Water and house heating, at equitable rates, would appear to be two other important potential fields for increasing the domestic load of gas. Even with all the technical advances that have been made, by far the larger proportion of water for domestic use is still heated by coal or oil, or inconveniently heated by non-automatic appliances. With the rapid progress that has been made in the science of water heating within the past few years, and the technical development of the appliances themselves, there is no reason why the gas companies should not be able to retain their markets and penetrate into others yet untouched.

The gas companies have but recently begun to develop the enormous business that may be derived from house heating, which in my opinion is destined to be one of the fuel's most important outlets. Housing is the most vitally important problem before the country today, and its solution will mean beyond question the greatest national building program ever conceived. It behooves us, therefore, to use every proper way to secure our proportion of this huge prospective business, and to this end we should be prepared to cooperate in every way with the home builder, giving him the benefit of our experience and technical resources, and where justified assist him in financing the installation of his heating system.

There is room also for a great deal of expansion in the commercial field, particularly in air conditioning, which in my opinion, is still in its infancy. Gas is just as efficient as any other fuel for this purpose, as is shown by the installations that have been already made. One of the finest hotel dining rooms in our state is air conditioned by gas, and there is no reason why gas companies cannot obtain their proportion of this constantly growing business.

A signal and significant phase of gas development in the past few years has been its growing importance in the field of industry. There are so many potential applications in the industrial field that merely await the further revival of industry and the call of enterprise on the part of the gas distributor that to mention them would almost run the gamut of industry. It can be stated as a generality, however, that wherever oil, coal, or other heating agent is employed gas can be used with equal or greater success.

Gas is now being used in the ceramic industry. To mention one of our newest applications, the finest china factory in the United States, the Lenox, at Trenton, N. J., has recently installed gas for the firing of its delicate porcelains, and our organization prides itself in having been a factor in this industrial development.

Collaborating with the American Gas Association, our technicians went into this plant and made a thorough study of the whole question of heat application to chinaware, and after considerable research and experimental work developed a gas-fired kiln which has been found satisfactory and so superior to kilns fired by other fuels, that similar installations are being made in other potteries, and it would appear that the use of gas will increase very rapidly in this important industry.

This is just one example of the wide range of undeveloped potentialities that is open to the progressive gas producer. Similar research is possible in many other major industries, and with just as good results.

There are so many potential uses of gas and so many present uses that have not been yet fully developed, that it is difficult to define the limitations of its ultimate province.

We must, as I have stated, prepare for the competition of the future, and be equipped to meet the problems of tomorrow as well as those of today.

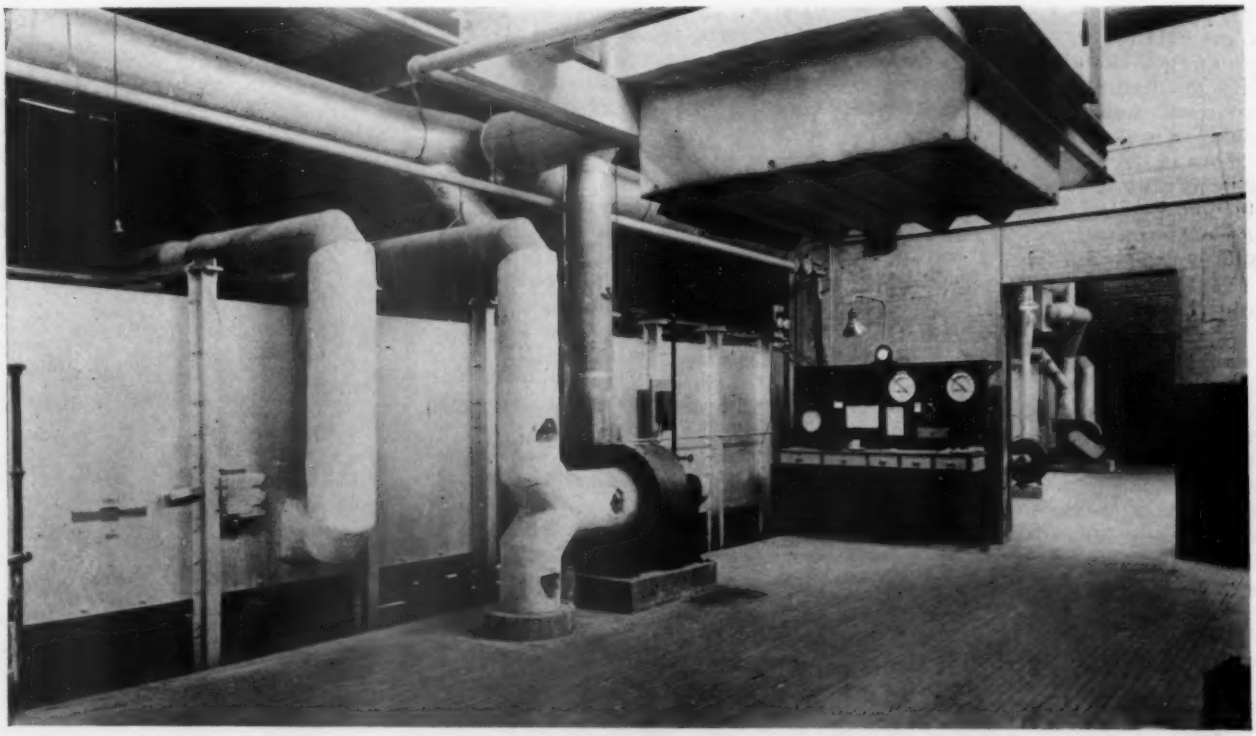
Unquestionably the most vital problem now confronting the industry is that of taxation.

I consider the tax situation, not only with respect to the public utilities, but to every branch of business, tremendously serious.

National, state, county, and municipal government is placing a burden upon industry that it is almost impossible to bear. The tax increases of our company in recent years, for example, have been prodigious, and we are now paying total taxes of approximately $19,000,000 a figure which represents 15.5% of our gross and 32.4% of our net earnings. With the projected old-age and other security legislation extended over a period of years, so that by 1945 it will require 6 per cent of our total payroll—this company will be forced to pay another $1,800,000 or more in taxes.

The solution I hold, can lie only in lessened costs of government, and one way such a result may be achieved is through the consolidation of political entities, particularly municipalities. Take our own state, for example. In Essex County alone there are 22 municipalities, any of which can be reached within fifteen minutes. Each of these municipalities has its own administrative machinery. They should be consolidated. Because of local prejudices and political ambitions, the attainment of this objective would be difficult, and if left to an autonomous vote of the communities never would be achieved. Thus the only way to bring such a very necessary reform about would be through a general plebiscite. It was through such a course that the consolidation of the municipalities now constituting integral parts of New York City was effected. The political cohesion of these latter municipalities never would have been possible had the determination of the question been left to each of them individually.

But with all the intricate problems and difficulties, I have consummate faith in the future of gas, if those of us engaged in this great industry will go forward resolutely and with confidence. For confidence is the greatest single asset of business.



Side view of continuous Glost Kiln showing control board and heat transfer ducts.

Selling Gas for Industrial Heating

Ralph L. Manier
Industrial Heat Engineer
The Syracuse Lighting Company, Inc.,
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EVEN the best product in the world has to be sold and kept sold as people and conditions are continually changing. Gas heat for industrial purposes is no exception to this rule. It has always had to be sold to the customer and kept sold against competition.

I like to define selling as the enthusiastic statement of true facts to the end that the prospect has the desire to use your product and finds justification for doing so.

The salesman must know his product and his prospect's problems. He must know of the competing sources of heat and their use. Most of all, he must have the ability to present his case in an interesting, forceful manner that will gain confidence and respect.

It might be well to review briefly some of the history of heat use in industry as it leads up to present day problems.

Prior to the world war, most of the heat used in industry for production purposes was derived from the combustion of coal, coke or oil. These fuels offered the greatest number of Btu per dollar.

The heat treating department in many plants was a necessary evil where a blacksmith plied his trade without direction or interference from the rest of the factory. This blacksmith, or heat treater, as he came to be called, was very secretive regarding how he accomplished results. He had learned his trade through hard experience and was very jealous of his knowledge. Temperatures were determined mostly by the operator's judgment of the color of the furnace lining and the stock being heated. Very little, if any, theoretical knowledge of the actual chemical changes which take place in steel was possessed by the treater. His work was accepted as there were not too strict specifications covering the finished product or accurate methods of testing. So long as any plant did not have a very large production, this condition continued to exist.

When production increased, it was found necessary to have more control over the heat treating departments. The larger companies employed metallurgists who specified the steels which should be used and the heat treatments which should be given the various parts. Means were developed to measure the condition of the part after heat treatment. A properly treated member was found to outwear and outlive an improperly treated one. It was soon discovered that much money was being lost when a piece of steel had been completely machined and then destroyed through improper handling in the heat treating department.

These, and many other factors, focused attention on the heat treating departments. Attempts were made to increase the uniformity of heat distribution in furnaces through better design. The solid fuels were gradually displaced by oil on the more delicate heating operations as oil could be more easily controlled than the solid fuels. Oil cost more than coal or coke but was justified due to its advantages. For the most part furnaces were home made and had no insulation to conserve heat.

About that time the gas industry began to form industrial sales departments. Many gas companies surveyed their potential market for industrial gas. Standard types of small portable heat treating furnaces were available but were not insulated. These were sold for tool treating and small production jobs. The higher operating cost than oil was justified due to the lower investment cost of

a gas furnace vs. oil furnace, tank, pump etc. Better quality work and less maintenance was claimed for gas, plus some labor saving. Convenience was a big factor.

During the war gas fired furnaces were greatly improved to meet production requirements for war material. For the most part they were still uninsulated.

When the automotive industry got into quantity production there was immediate demand for automatic continuous furnaces. Gas furnace manufacturers had had very little experience with the moving of large quantities of materials. The electric motor manufacturers were familiar with this problem. They built conveying equipment and enclosed it within well insulated walls. Electric heating elements were hung inside and attached to controls which automatically controlled the temperature. Gas men said electric heat could not justify itself, but it did. There came to be a word "Form Value" of fuel or heat which referred to the controllability and flexibility of such source of heat. By the use of high grade insulation the electric men eliminated much of the wall heat loss experienced in fuel fired furnaces. Due to the absence of products of combustion, the furnaces were in many cases placed in the line of production as they were as clean as any machine. Thermostatic control supplied with the furnace was a Godsend to the manufacturers. Alloy steel was developed which was said to stand up in electric furnace conveyors three times as long as in an oil fired furnace conveyor. The need for continuous operation was such that the high priced alloys were justified.

Entrance to Continuous Glost Kiln.

Here was a source of heat much more expensive than gas heat, taking business away from oil which the gas men hadn't been able to touch. How were they doing it? Would the furnace make good and stay in use? These were some of the questions the gas industry was asking.

The electric furnace builders, with the assistance of power salesmen, proved to the manufacturers that they could produce a given quantity of work at a cost enough lower than the cheaper fuels to justify the displacement of the existing fuel fired furnaces with new automatic electric ones. Often the savings, not in heat, but in unit cost of production, would amortize the investment in three years or less. Experience proved their claims fair.

Was there anything they were doing that the gas industry couldn't do?

A careful analysis of their methods showed that they made a thorough study of the problem at hand and then designed a furnace to do the job. In their study of existing conditions they made note of rejected material, cause of rejection, cost of product in that state of fabrication, labor costs of handling materials through furnace, maintenance costs, working conditions, floor space required, fuel cost, fuel handling costs, costs of operating auxiliary equipment and many other items. There was no question in their prospect's mind but that an automatically controlled continuous furnace should greatly reduce rejects due to faulty or non uniform heat treatment. Much labor should be eliminated by changing from batch type heating to continuous heating. There should be no refractory maintenance cost with electric heat. Working conditions should surely be much better with clean electric heat. The electric furnace was designed to give the greatest production per square foot of floor space as floor space was often at a premium. Much less Btu were required with a well insulated electric furnace than with a fuel fired furnace, but still the cost of electricity was greater than fuel. However, when money values were given to the costs other than fuel such as rejects, labor, maintenance, credit for improved working conditions, saving in floor space etc., electricity became interesting. When the replacement cost of alloy conveyors was charged against fuel fired furnaces at three times the rate against the electric furnace, the scales balanced in favor of electric heat in many cases.

The gas furnace manufacturers had tried to sell insulated furnaces but had been unable to get the buyer to pay the price. If the buyer was considering an insulated electric furnace, surely he could be sold up to the price of an insulated gas furnace.

If good mechanical handling were designed for a gas furnace, the handling labor should be no more than for the electric.

There was no reason why the control equipment which operated switches could not operate valves.

The alloy steel manufacturers agreed to guarantee the same life of alloys in gas as in electric furnaces.

As a result of such reasoning and analysis many insulated continuous gas furnaces were sold and installed. Many of these were large units designed for increased production as the plants were all expanding.

When the depression started these larger units became rather a handicap. A large counterflow heat exchanger type normalizer is not good at light loads. The radiation loss continues but less work goes through. The result is a very great increase in heat required per pound produced. The continuous pusher type pot carburizing furnaces had the additional difficulty of maintaining proper time temperature curves on light loads.

From the above experience, today industrial heat men tend to recom-

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Stray currents may originate in such conditions as this illustration particularly when considerable change in elevation occurs in comparatively short distances.

Pipe Corrosion and Coatings

Part 4

By
Erick Larson

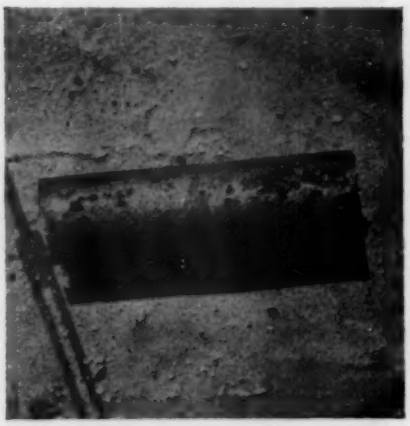
Stray Current Electrolysis

A fundamental of stray current electrolysis is that the current originates at some source foreign to or remote from the location of corrosion and travels along conductors, which may or may not be the gas line. Finally, however, it does travel along the gas line and results in corrosion where it leaves. The reaction at the point where the current leaves is frequently similar in nature to galvanic action in that the current removes part of the metal, the pipe line being anodic to the surrounding soil. On the other hand, there is a distinct difference between galvanic action and stray current electrolysis since two dissimilar metals are not required to produce the latter.

The stray current which causes electrolysis is confined to a conductor, which may be the gas pipe, only so long as the pipe provides the path of least resistance. Should there be an electrical connection with some other conductor along the pipe line, the current carried by either or both will be distributed between the conductors in proportion to the resistance offered by each. If there is direct contact there will be no transposition of metal at the point, line or surface of contact. However, if there is a gap between the two conductors and the current must leap across the gap, then intensive electrolysis will occur at the point where the current is discharged. Current flows along a conductor because there is a difference of electrical potential or pressure existing between two points on the conductor. The current flows in an effort to equalize the pressure difference. The resistance to the flow of current offered by a buried conductor may become greater than that offered by the surrounding soil; and when that happens a part or all of the current will leave the pipe, taking with it some of the pipe metal.

The question of what constitutes an electrical conductor may be eliminated when considering any of the metals used for conveyance of gas, since metallic pipes offer but little resistance to the flow of the small currents as are usually encountered in stray current electrolysis. Joints, however, whether purposely designed or not to provide resistance to current flow, are factors in decreasing the current entering a "hot spot." The alteration with time as well as the initial electrical resistance of both standard and insulating joints is a factor, especially when a long life expectancy is desirable. Insulation is especially important when using cast iron pipe with mechanical joints. Such joints, unless especially designed, provide practically no electrical resistance in comparison with bell and spigot joints, even when caulked with lead.

In proportion to the area where current may be collected by mains, the area of the metal from which it



Effect of stray current electrolysis. Part of surface has original mill scale intact.

leaves is usually small. This is true even where the length of pipe along which current leaves is several hundred feet in extent. The current does not dissipate itself uniformly along the whole discharge section but concentrates at many comparatively small areas because of highly localized soil conditions. **This results in pitting rather than uniform corrosion. Pits are a result of the intensifying of current at the points of corrosion concentration. The whole area in which the pipe has a higher electrical potential than the surrounding media, which is usually soil, is sometimes termed a "hot spot."**

The loss of metal may be theoretically computed from the following equation.

$W = I \times T \times Z$

W = Weight of removed material in grams (1 pound = 453.59 grams)

I = Amperage of the current leaving the pipe

T = Time of current flow in second of the current leaving the pipe

Z = Electro-chemical equivalent

The electro-chemical equivalent of copper is 0.0006588—valence of 1; copper—0.0003294—valence of 2; zinc—0.0003387; tin—0.0006166—valence of 2; tin—0.0003083—valence of 4; lead—0.0010731; iron—0.00001929—valence of 3; iron—0.0002893—valence of 2; aluminum—0.00001936.

One ampere running continuously for one year under ideal conditions will carry off 20 pounds of iron and 74 pounds of lead. Actual loss, however, varies between 20 and 140 percent of the theoretical.

The difficulty of predicting the effect of stray currents by computing with a formula the weight of metal which should be removed is that the area from which the metal will be removed is unpredictable. When the effect is pitting rather than uniform corrosion, the life of the pipe will be considerably less. For this reason interest is focused upon the flow of the current and its continuity, which is susceptible to accurate field determination. This will be more fully discussed under electrolysis surveys.

The reason why interest is focused on continuity of current is that the current frequently changes in direction, especially when of small intensity. Therefore, an area which may be anodic during one period apparently collects current or is cathodic at another time. The period during which current flows in one direction thus becomes of major importance in determining its corroding effect. The time which should be used in determining the loss of metal should only be taken as that during which current flows into a particular "hot spot". The fact that the direction of current flow may change does not alter its effect during the period of discharge at any particular point. Electrolysis is not reversible. However, it will usually be found that when a current alters in direction its total flow at any particular time is small and frequently may be neglected even on bare pipe. Having determined that the direction of flow in any one direction is of sufficient duration to result in possible corrosion, it then becomes of major importance to determine the intensity of the current flow.

The current flow is determined by one of the two common electrical methods: (1) of directly measuring the current, or (2) of securing the potential drop along a known distance and computing the current flow from electrical flow formulae. In using the potential drop method the cross sectional area and type of metal in the conductor should be uniform for the full distance between contacts. For instance, if there are joints between the points at which leads are taken off to the electrical resistance than the pipe itself, thereby affecting the accuracy of computed amperage. When measuring flow directly, it is necessary to have an insulated joint in the conductor or to interrupt the continuity of the pipe and connect the ammeter leads from each of the disconnected ends.

Knowing that a current exists, the value of which is sufficient to cause corrosion, there are two possible methods of mitigating or overcoming the effect. One is to trace the current to its source, or the point or points at which it commences traveling along the main, and eliminate that source or electrically isolate the section in which corrosion occurs. A second is to determine the area in which corrosion is occurring and conduct the current from the pipe before it enters the corroding section, or to apply cathodic protection at the points where the current leaves.

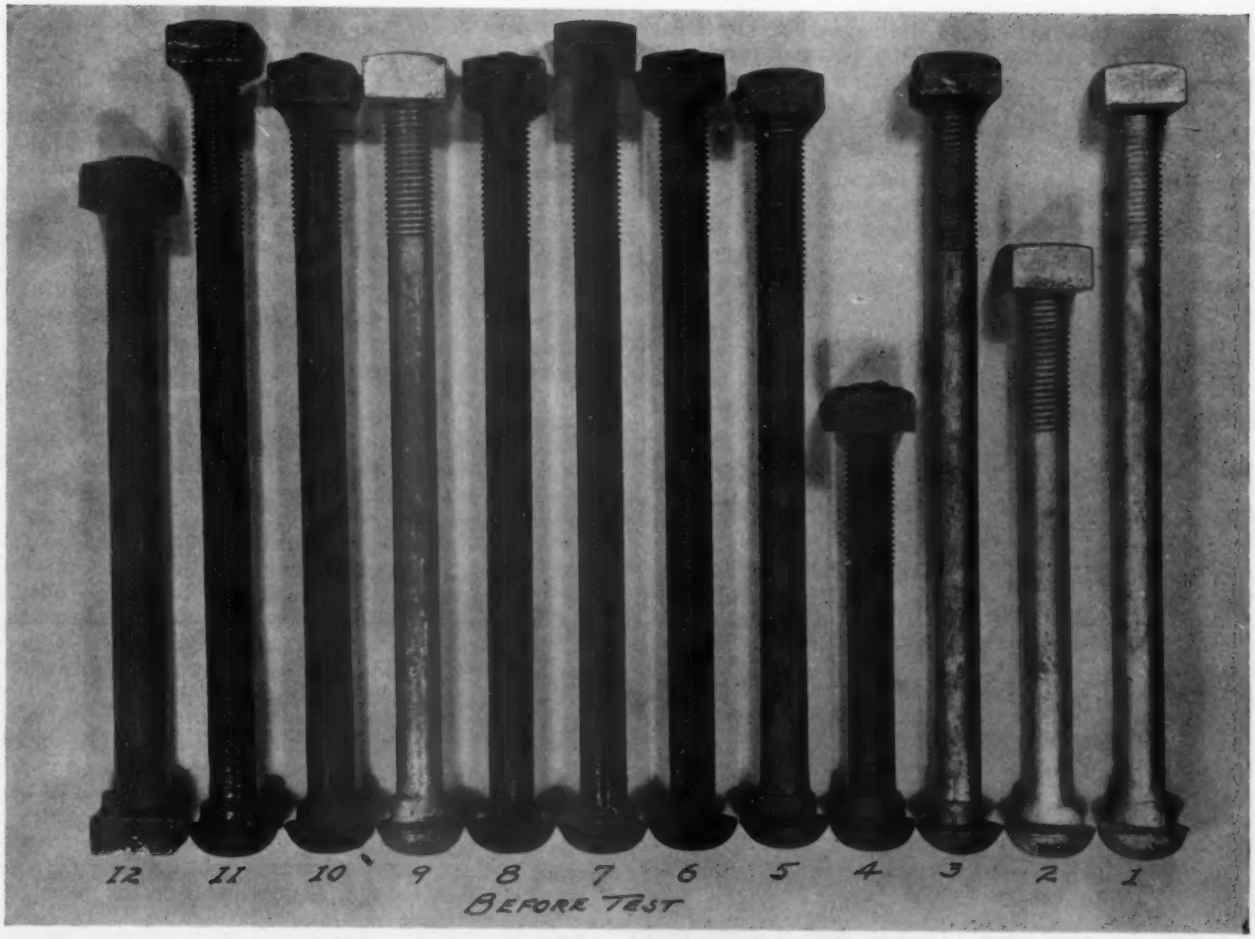
Sources of Stray Currents

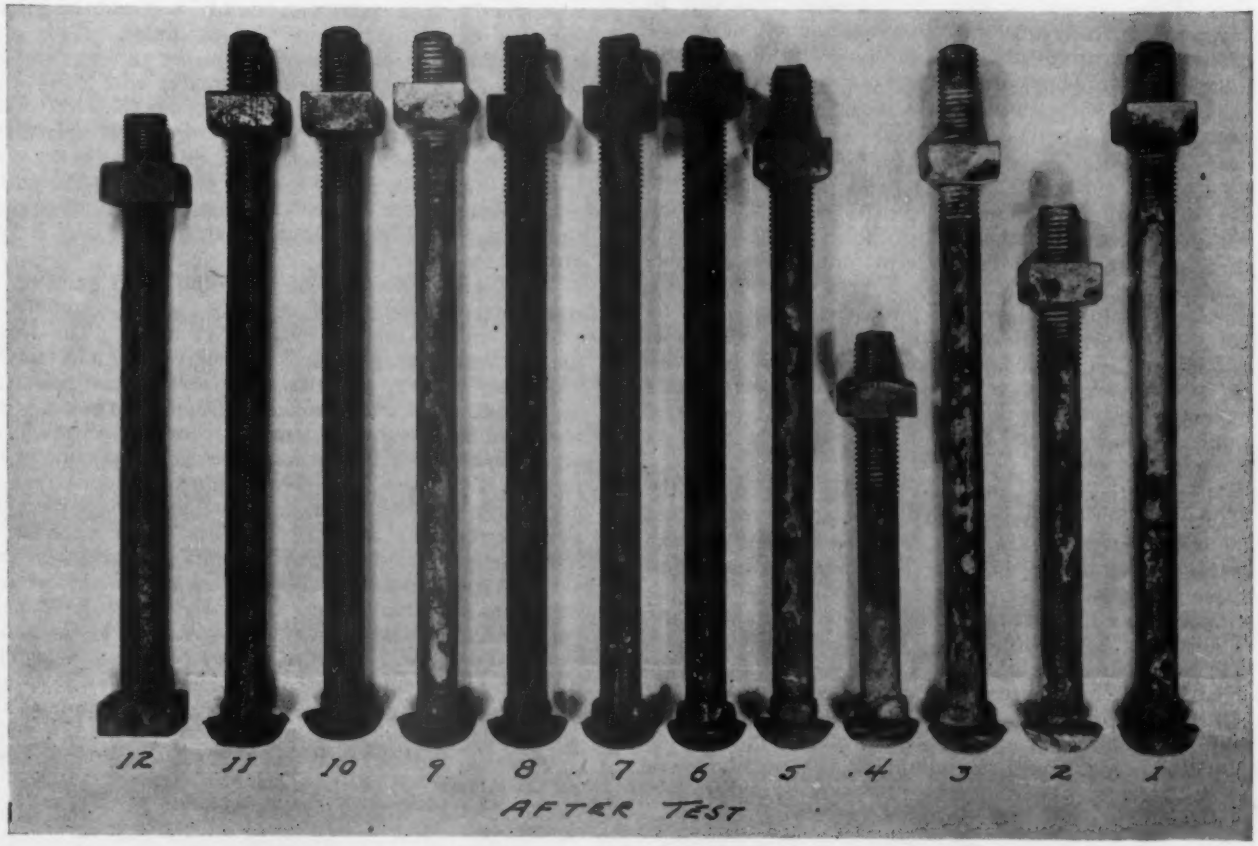
Stray currents originate in various and numerous ways. There may be a current leakage from regular electric distributing lines direct into the gas system, or from some such original source through the medium of one or more of the many metal sub-surface structures other than gas into the gas system.

Ground wires on electric meters or any type of electric apparatus may be the source of a current; but most frequently such currents are of the alternating type and do not cause electrolysis. Many gas companies have rules against the use of a gas pipe for ground wire purposes. Such rules, however, can not be effective unless continuous inspection is maintained and this is costly and impractical. Gas companies have jurisdiction only over the use of their own property for ground wires and, therefore, riser pipes may be used and not come within the scope of gas company rules. Even though the ground wires are on water or other types of pipe, such lines are usually electrically connected to the gas pipe through the medium of water heaters, house heating units, ranges, etc. Due to the type of joints used, water and sanitary services and mains usually offer more resistance to the flow of electrical currents. Therefore, the major portion of current collected will be carried by gas lines. When gas piping is used for a ground, insistence on a good electrical bond located between the master shut off valve and the cellar wall, where it will not interfere with the operation and maintenance of equipment, is ordinarily more practical than attempts to prohibit such use.

Electric sub-stations or pole type apparatus, though not ordinarily directly connected to any pipe lines, may be source of stray currents as the earth will conduct currents to sub-surface structures. These escaping currents do not ordinarily follow a straight line in their return to generating stations, but seek the path of least resistance even though that path may be long. The complexity of electric distribution systems precludes the use of effective means for directing the path of currents returning to generating stations such as are possible with electric railways.

The return conductors for an electric railroad are usually the rails. At a considerable distance from generating stations the potential of return rails frequently is high due to poor or improper bonding of the rails. In such case, current is more likely to jump from the rails to ground or other nearby conductors. As the





Results of Stray Current Corrosion Laboratory Tests made by S. R. Dresser Mfg. Co.

generating stations are neared, drainage of current from the rails at the station lowers the potential, and frequently mains are at a higher potential than the rails. This produces a condition favorable for currents to leave the pipe line; and if they do, stray current electrolysis results. Electrically connecting the pipe and return rail at points where the potential of the pipe is usually higher than the rail will provide a path for the current to leave the pipe line without any damage. Particular care should be used to secure an effective bond. Electrically connecting two conductors will be designated by the general term *bonding*.

Stray currents originating from such sources as electrical apparatus or street railways are frequently termed "leakage" currents, as they are an actual loss to the power company. The fact that commercially generated currents tend to travel in a circuit is an important consideration in stray current electrolysis. A knowledge of the location of the major generating or converter stations will frequently facilitate conducting an electrolytic survey.

"Earth" currents are electrical currents originating from natural differences of potential between various soil areas. A greater flow of current takes place when the two areas are connected by a metallic electrical conductor. There is also reason to believe that earth currents may be caused by wind and cloud movements. Differences of electrical potential occur between vertical as well as horizontal earth strata. That earth currents may be of an intensity sufficient to be harmful to gas pipe lines has been substantiated by electrical measurements on lines which at no point approach within miles of any source of electrical generation, transmission or distribution. Rather rapid corrosion of large diameter pipe lines buried so as to pass vertically through different soils has been attributed to the potential difference between the various strata. Substantiation of the contention that the corrosion was due to earth rather than stray currents was secured by actual electrical measurements along the pipe and between the layers of soil. These indicated that the destructive current was caused by differences in the potential of the layers of soil.

It is conceivable, though very infrequent, that the flow of gas through a pipe line may result in a static electric charge accumulating on the pipe. When the charge exceeds the capacity of the main to retain it, there may be a static discharge at some point and this might act in the same way as a stray current in producing corrosion. However, static electricity has high voltage but very little current. Therefore, the effect would be minute, as is demonstrated by the long life of spark plug electrodes. A pipe line also offers many opportunities for the dissipation of a static charge as rapidly as it is formed through the grounding effect of the adjacent soil.

It is practically impossible to tabulate and explain the many possible sources of electrical currents conducted by sub-surface metallic structures and, therefore, the brief outline of sources has been for two purposes. First, currents may originate from man-controlled generation, transmission and distribution of electricity. Tracing the source of these is a localized problem requiring accurate field surveys and knowledge of the existence of the sources. The second important purpose has been to indicate that the absence of any known sources of artificial electrical generation, transmission or distribution would not eliminate the possibility of stray currents. They may be produced by nature. A conclusion can only be reached after a field survey to determine the existence of currents, and a single test may not be sufficient.

Effect of Stray Currents

When discussing chemical reactions the cumulative effect of all factors was stressed. Similarly, it is the effect of the sum total of current reaching a particular point of discharge, rather than the current intensity measured at any particular point, which causes stray current electrolysis; and it is possible that chemical and electrolytic corrosion may occur simultaneously. The potential difference between two structures may be of such intensity that the current discharge will be in the form of a visible arc. This is especially true when two metal sub-surface structures, having a large potential difference, all but touch physically at what amounts to a point, a small area or line. When the intensity of the voltage is sufficient to produce a visible arc a hole may occur, depending on the value of the current, in the walls of both structures rather than be limited to the one from which the current leaves. In such case the melting effect of the arc causes the damage rather than electrolysis. Punctures caused by one or more flashovers, or arcs, usually have the characteristic beaded or droplet appearance of molten metal rapidly cooled, particularly around the rim of the corroded area. Bonding is the most effective means of preventing destruction from arcing; but the bonding may increase the current flow on the gas mains and cause more extensive though less rapid failure of the pipe at the location of current discharge than was produced by the single arc.

The effect and appearance of stray current electrolysis is similar to that of galvanic or ordinary chemical action in many instances. Definite determination of the cause can only be obtained by a field survey which should include current measurements on the main.

A particularly destructive action of stray current electrolysis is the selective loss of metals from alloys or compounds. The dezincification of brass and the graphitization of cast iron pipe are examples. Both may occur from galvanic corrosion, but the rapidity and intensity of the action is usually greater with stray current than galvanic electrolysis. During the electrolytic corrosion of metal mixtures a preference is shown for one of the metals; and the loss of this metal is not confined to the surface, but extends throughout the entire structures. After electrolytic corrosion of alloys, the remaining metal lacks the original strength and is frequently spongy.

The relative intensity of corrosion from galvanic or stray current electrolysis depends upon the amount of current causing the transposition of metal. The formula for determining the loss of metals from electrolysis has three factors, a constant for each metal, time and amperage. The amount of metal removed from a given structure by galvanic or stray current electrolysis in an equivalent time will only have the electrical current intensity as the variable. The self generated current of a galvanic cell has a maximum value far less than the average intensity of stray currents where such exist. The damage caused by stray currents is, therefore, practically always more rapid and intense than that resulting from galvanic action. Similarly, galvanic electrolysis damage is usually more rapid and intense than chemical action. Therefore, it may be stated that under average conditions stray current electrolysis causes the most rapid damage, usually followed by galvanic action and finally by chemical action. However, the difference is only one of time, as the final result of any corrosion action is removal of the metal.

(Continued on page 108)

Gas Marches On

FOR more than three-quarters of a century, the "American Gas Journal"—the oldest publication in its chosen field—has worked incessantly in the interests of the gas industry and the men who are engaged in it. It takes pride in what it has achieved in contributing to the industry's upbuilding. It has furthered the cause of gas not only through its contributions to technological practise, its dissemination of news, its consistent fight for the maintenance of a high standard of ethics, but for its readiness at all times to stand up for the industry when it is attacked.

The present is such a time. Never in the long and splendid history of this great key industry has there been such need for confidence, co-ordinated action, and continuation of faith in its future than now. Gas is called upon not only to meet acute competition, to repel the unfair attacks of unscrupulous politicians and uninformed, irresponsible people, but must also arm itself against the widespread propaganda aimed at the destruction of our industry.

Gas will survive, and will grow in stature and usefulness in the future. However, its measure of success will be determined by the extent to which we maintain our morale. We must believe with all our hearts in the future and destiny of our product. We must not permit ourselves to be influenced by biased statements that would suggest that the industry's star has set, or is on the wane.

Ordinarily we do not take issue with our contemporaries serving the electric industry but on occasion we feel constrained to, especially when they publish articles that seek to affect our industry injuriously.

There appeared in the August issue of "Electric Light & Power," published in Chicago, an article that we regard as misleading and so perversive of the true facts that we can not permit it to go unchallenged.

We refer to the article entitled, "Electric Cooking Invades Gas Strongholds." It purports to show from authoritative sources that electricity is so rapidly replacing gas that it will be only a matter of time when gas will no longer be a dominant factor in this field.

It would appear to us that the substance and whole purpose is to "pep up" the electric appliance salesmen, inspiring them to greater efforts by inoculating them with the idea that gas is passing right out of the picture in the domestic sphere.

It makes the bold, unsupported claim that 34 per cent of all electric range sales represents replacements of gas ranges, and that in some instances the percentage of replacement ran as high as 70 per cent. "The figure of 34 per cent for replacing gas ranges," it continues, "will probably hold its own in future years because active campaigns are now being carried on in big eastern cities, tapping a market heretofore closed to electric ranges." However, the article fails utterly to take cognizance of the rapidly mounting sales of gas cooking-appliances.

No figures from the United States Government are given in support of the statements made, which, for the most part, are the casual utterances of men engaged in promoting electric appliances. For example, New York & Queens Electric Light & Power Company reports "2,076 electric ranges sold, among 4,300 employees in 22 working days, according to L. J. Montgomery." "Range campaign unit sales are 2,000," says C. L. Harold, Brooklyn Edison. "Detroit Edison reports sales of electric ranges amounting to 5,000, and that 68 per cent represented gas replacements." "Hartford, Conn., reports that 90 per cent of their 3,700 sales of electric ranges represented gas replacement." And so on, ad infinitum.

What the article failed to disclose, however, was that in practically every region where gas is available the sales of gas ranges more than counterbalance electric displacement. It failed to tell its readers, for example, that in spite of acute electric competition the Brooklyn Union Gas Company sold 12,436 ranges in 1935 compared with 10,599 the preceding year, and that sales this August, the last figures available, amounted to 1,182 compared with 970 for the corresponding month of 1935. They failed to mention, also, that the gas appliance sales of the Public Service Electric and Gas of New Jersey for the calendar year 1935 showed an increase of 43.15 per cent, whereas the increase in the sale of electric appliances was only 8.01 per cent. Nor did they see any reason for stressing the point that high pressure methods must have played no inconsiderable role in the employee sales of the New York & Queens Electric Light & Power Company, considering the fact that total electric range installations in the entire borough of Queens today are less than 5,500.

A somewhat similar method of analysis as that employed by "Electric Light & Power" was apparently used by the electrical interests in Great Britain recently, for we read in the September 9 issue of the "Gas Journal," a leading publication in its field on the other side of the Atlantic, which in a leading editorial cap-

tioned "Electrical Competition" has this to say:

"Electricity by no means for the first time, had excellent publicity in "The London Daily Times" for September 1, when an article—significantly enough entitled 'Slave of the Switch' by Sir Arnold Gridley—was given prominence on the leader page. The author stated that during last year the number of electric cookers installed in Great Britain was equal to that of the whole of the rest of the world, and that in the large cities of this country the development of heavy consuming appliances, such as cookers and water heaters, is proceeding more rapidly than anywhere else in the world. Wisely, however, the total number of cookers installed was not given, and naturally no comparison with the enormous number of gas cookers installed was made. In this regard, we may recall that in 1935 the Gas Light and Coke Company alone supplied 603,000 new appliances, of which more than 364,000 were cookers and 66,000 were water heaters; and only a few weeks ago we referred in these columns to the fact that during the first six months of this year the rate of sale of appliances had not only been maintained but surpassed."

In the foregoing statement can be found the crux of the entire situation. Articles such as that in "Electric Light & Power," fail significantly to present the true picture. Making no attempt at analysis of the available statistics on hand, they present only the figures of electric appliances sales. Could it be possible that a true analysis might be too revealing? Could it be possible that it would divulge a considerable replacement of electrical appliances with those burning gas? Such a thing is not impossible.

Consider, for example, the following: In the twelve months since natural gas was made available to the citizens of London, Ontario, a city of 80,000, and where was born the great electric scheme of Sir Adam Beck, Ontario Hydro Electric, contracts have been consummated for no less than 5,273 central heating jobs. Furthermore natural gas has replaced all other heating and cooking agents in nearly one-half of the community's 12,200 centrally heated homes. And this in a region that is said to be served with the cheapest electricity on earth for domestic purposes.

In a consideration of electric competition, it should always be kept in mind that where gas is not available the use of the electric range necessarily increases. It is equally obvious, too, that comparative statistics for this reason are not only unreliable and misleading but definitely inaccurate, for while some sections have no gas supply nearly every section has its electric wires.

Recently, it has become a common practice to show the growth of electricity as a cooking agent by publishing percentage increase figures of range sales. What does this method of comparison convey? Nothing at all. Suppose for example that last year a certain community had 5 electric ranges, and this year the company sold 10. This would mean a two-hundred-per-cent increase, and yet there would be only 15 ranges in the town. Unfortunately, this is the accepted method of calculating electric appliance sales increases.

But now let us view the situation from an authoritative point of view.

Let us consider briefly a bulletin of the United States Bureau of Foreign and Domestic Commerce, entitled, "Markets for Electrical and Gas Facilities In Residences," and dated only last month. It covers 64 non-metropolitan cities, and shows that gas has no successful rival in the urban homes as a cooking agent. These surveys, it says, "show no appreciable use of electricity for cooking purposes." Every geographical section of the country is embraced in the survey and the percentage of gas used varies from 40 per cent in Columbia, S. C., to 97 per cent in Racine, Wis., the average for all of the 2,633,135 dwelling units surveyed being 69.4 per cent. "Gas is to cooking," says the report, "what electricity is to lighting."

It is not our intention to make invidious comparisons between the relative merits of gas and electricity. We believe with Mr. Thomas N. McCarter, President of Public Service Corp. of N. J., when he says in the leading article of this number that each has its own field, and there is no reason why each should not fulfill its destined role, and with Mr. Clifford E. Paige, President of the Brooklyn Union Gas Company, who in the leading article in the September issue of the Journal said: "For myself, I state it to be axiomatic that the efficient gas company can meet competition of any character except the competition of subsidy."

Pressure Regulation in the Transmission and Distribution of Gas

by

Allen D. MacLean

Chief Engineer
Pittsburgh Equitable Meter Company

THE entire gas industry must, of necessity, be "pressure conscious." From the appliance adjuster, who requires a satisfactory pressure to obtain good combustion in the appliance he is working on, to the engineer who designs and builds the transmission and distribution system, pressure is a prime consideration. In particular, three phases of gas work are very dependent on pressure, and in order to insure efficient operation in these three departments there must be, all along the line, careful control of pressure. These three phases are safety, measurement, and combustion.

It is almost obvious that for safety there must never be more pressure on any part of a transmission or distribution system than the parts can physically withstand. Such a dangerous and valuable substance as gas can not be allowed to burst any of its containing members, or be allowed to escape into the atmosphere unburned. Hence pressure must be controlled to prevent going above a safe value in any part of the system. Safety in the distribution of fuel gases must come from the pressure *regulating* devices rather than from safety valves such as used, for instance, in steam work. Safety valves should be regarded only as a last resort in gas work.

The pressure to be maintained on a gas piping system should be high enough to overcome the pressure loss due to friction, and deliver gas at the utilization point at satisfactory pressure and quantity. Any higher pressure than this should be avoided.

Measurement, at any point in a fuel gas distribution system, is accomplished with but very few exceptions, by either a volume displacement principle (diaphragm and rotary meters), or a velocity principle, (the orifice meter). In both of these systems of measurement, while the result is spoken of in terms of cubic feet, the cubic foot is described either by contract or by precedent, as cubic feet at a very definite pressure. In effect, by defining cubic feet at a definite pressure, (and also temperature) we are measuring weight of gas. When measurements are made at varying pressures, some means must be provided to obtain the equivalent cubic feet at contract pressure, that is, in effect a correction made to bring the measurement to a weight basis. For this reason, when we measure gas, with either positive or orifice meters, the pressure must either be accurately controlled, or accurately recorded.

In the combustion of gas, too, is pressure of extreme importance. Any customers service man will attest to the fact that a large share of

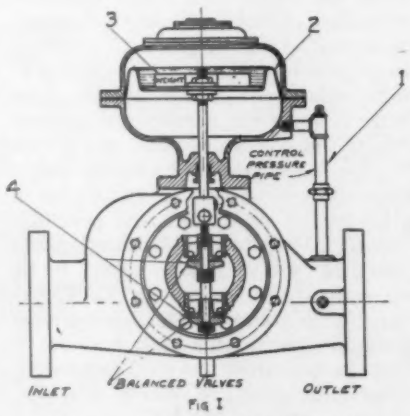


Fig. 1.—Simple Weight Regulator.

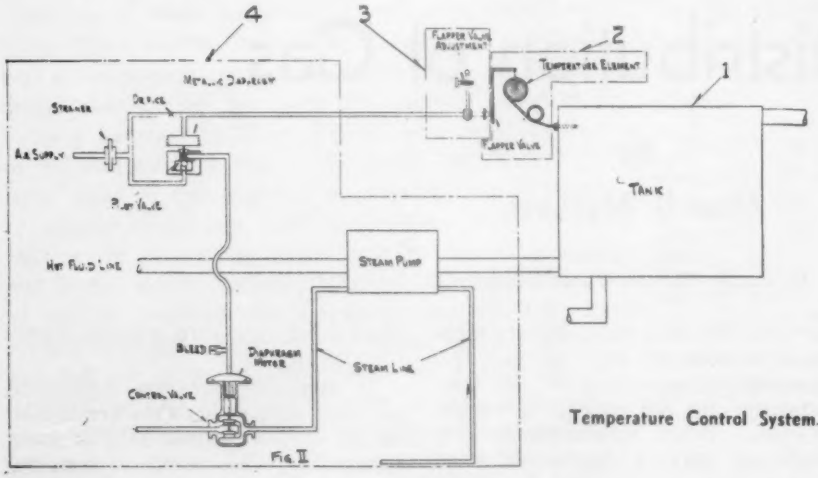
complaints in this field originate from pressure conditions; either too much pressure, too little pressure, or a too widely varying pressure. Rate of heat input, proper mixture with air, height of flame, all require accurate control of pressure. This pressure control may originate with a regulator on the appliance, with a district regulator in the distribution system, with a regulator on the service, or from the weight of holder lifts; but it must be regulated from some point. So combustion will rank along with safety and measurement, as the three phases in gas work where pressure is an all important factor.

In analysing pressure regulators, we soon realize that they are similar to the control devices used in many industries. The control of temperature, humidity, many electrical functions, resort to the same general form as we find in pressure regulators. We usually find four major steps in all automatic control work. First, there must be something to be controlled; second, there must be a member responsive to or affected by the function to be controlled; third, there must be a standard to which this member constantly refers itself; and fourth, there must be a means or a system affected by this member which indirectly or directly can influence the function to be controlled.

In looking at Figure I, which is a simple weighted pressure regulator, we have at "1" pressure to be controlled; at "2" a member (diaphragm) responsive to the pressure to be controlled connected to it by the control pipe; at "3" a weight system to which the diaphragm must compare and adjust itself; and at "4" valves operated by the diaphragm to restrict flow. In actual operation an increase of pressure at "1" affects the diaphragm at "2" so that it overcomes the weight slightly, thus tending to close the valves, and by restricting flow reduce the pressure at "1". When the valves are finally at the correct position the weight system will balance and the system will be in equilibrium. Any factor tending to change the pressure at "1" will start the whole system to operating again until a state of equilibrium is again reached.

In contrast to the simple lever and weight pressure regulator above, Figure II shows a widely used temperature control system which, while complicated, consists of the same four essential elements. At "1" we have the temperature to be controlled; at "2" the temperature re-

sponsive member moving a flapper in response to the temperature of "1" In this case the reference point "3"



Temperature Control System.

to which "2" continually adjusts itself is a nozzle which can be moved to be set for any given temperature. "4" is in reality a somewhat complicated system instead of a simple mechanical connection as in the case of the regulator. By means of this system air pressure is controlled by the flapper valve into a capsule at A, so that the bleed to a diaphragm motor B can be controlled. This motor valve B controls the steam to a pump which in turn controls the

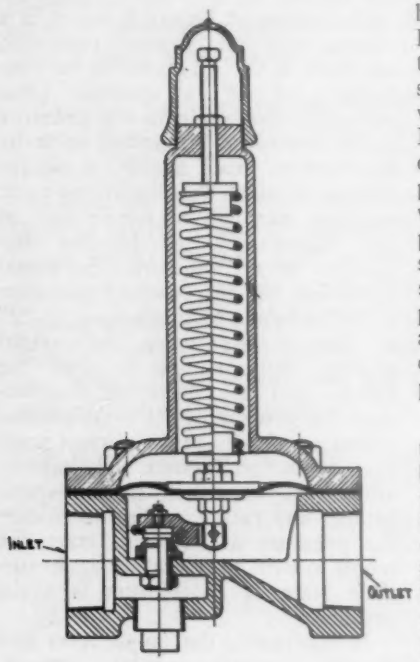


Fig. III

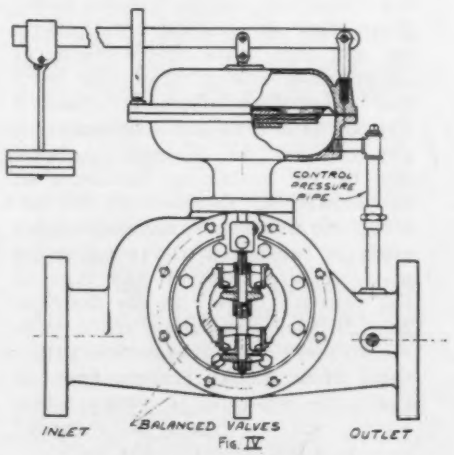
Spring Type Field Regulator.

amount of hot liquid pumped into the tank and thus affects the temperature at I. In these two installations we have shown on one side the simplest and on the other the most complicated system of controls normally met; all others are in between these two. All have the four essential elements mentioned above.

In reviewing the type of control normally used in gas pressure regulation we have already in Figure I seen the simplest—the weight type regulator. In Figure III a spring type regulator is shown. Here we have simply given the responsive element, the diaphragm, a little different reference member to work against, by replacing the weight with a spring. In Figure IV, a lever and weight system capable of much higher pressures is used for a reference against which the diaphragm can work. In Figure V we have still another reference system. This is known as a pilot loaded regulator, and here the weight or spring is replaced by a pressure which is controlled by a separate small regulator. The pressure to be controlled under the diaphragm continually refers itself to and adjusts itself to this accurately controlled pressure above the diaphragm.

Figure VI is still another modification in which the responsive member is included in a separate small regulator at E and continually refers itself to and adjusts itself to the weight on its diaphragm. By varying its orifice in response to the outlet pressure it changes the pressure in the main diaphragm D, which being applied over the total area of this large diaphragm positions the valve to give the proper pressure at the downstream side. In the actual working of this system a small flow is established through regulator B, needle valve C on to the inlet of regulator E, and then after passing through regulator E on to the outlet of the main regulator at F. Even the slightest increase in pressure at F immediately raises diaphragm of E, thus tending to back up and increase the pressure in the diaphragm chamber D. This increase in pressure may be several pounds, sufficient to forcibly move the main valves so as to restrict flow. Conversely any decrease in pressure at F allows diaphragm in E to drop, resulting, because of needle valve restriction at C, in a large drop in pressure under diaphragm at D. Regulator B merely protects this pilot flow system from being affected by changes in inlet pressure. Thus, analogous to relay systems in electrical work, a small change in pressure at F causes a large and positive change in pressure at D.

Occasionally there are used other systems of gas pressure regulation in which the responsive member, instead of being a diaphragm, is a pressure element such as used in pressure recording gauges. This element is made to back up or release pilot bleeds very much as in the system shown in Figure VI. This modified pressure then applied to a diaphragm controls valve position.



Lever and Weight Type Regulator.

We have listed above the main systems used in gas pressure control. Let us look at the actual equipment used in this work and study some of the details essential to good regulator performance.

In the transmission of gas over long lines, such as from the natural gas fields to the cities where the gas is to be utilized, very high pressures are often times encountered. Six hundred pounds per square inch at the outlet of compressor stations is occasionally required to get sufficient volume through the lines. At city

gates along these lines it is obvious that pressure regulators must be used to reduce this pressure to a safe and satisfactory measurement pressure first, and then a safe pressure for distribution to the industrial and domestic consumers who will utilize the gas. Pressure regulators for this work must be designed with respect to safety at these high pressures, to handle the volumes required, to withstand the abrasion of the throttling action in reducing the gas pressure, to withstand thermal changes incidental to extreme pressure reductions, and to insure accuracy in holding the outlet pressure.

When the drop in pressure across the station is to be large, often times two or more regulator stages are used. That is, regulators are arranged in series, the first controlling its outlet to some intermediate pressure, which becomes the inlet of the second, and so on. This scheme has several advantages. First, by using stages, each regulator will have a larger valve opening at a given rate of flow than if one stage is used. Extreme wear and abrasion is in this way avoided. Second, the final stage which will govern the accuracy in the final outlet pressure is working over a small pressure reduction, and with a larger valve stroke than if a single stage were used. This means a much better chance to adjust the valve opening for the correct final outlet pressure. Third, this multi-stage system is safer, in that if any one regulator fails to limit its outlet pressure, the other regulator or regulators in series will prevent at least the full inlet pressure arriving at the final outlet. Fourth, the fact that the gas is being throttled in many small steps, with ensuing turbulence, rather than in one step oftentimes prevents freezing of the regulator which might occur if only one stage were used. This matter of freezing will be dealt with in a later paragraph.

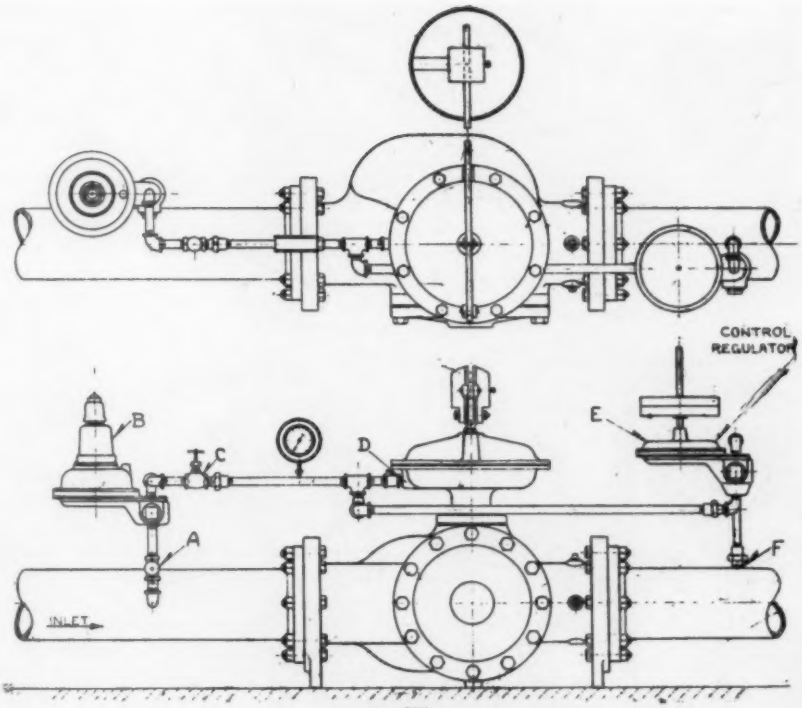


Fig. VI
Pilot Controlling Regulator.

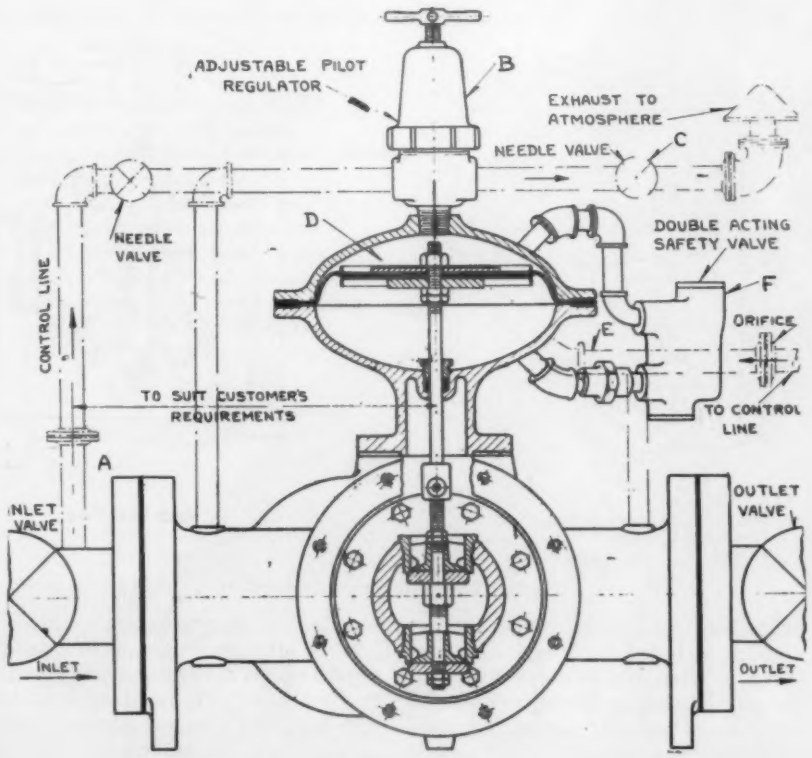


Fig. V
Pilot Loaded Regulator.

Usually because the outlet of this type of regulator is high, (over three pounds) the type of regulator used is that shown either in Figure VII, Figure VIII, or Figure IX. If an extremely accurate control is not desired, the simple lever and weight type (Figure IV) will do. It is easily adjustable and rugged. The diameter of the diaphragm head will of course be determined by the outlet pressure range to be controlled. High outlet pressures will require a thicker diaphragm material and smaller diaphragm diameter than the lower ranges. The following table gives the recommended diaphragm size for the various outlet ranages. (See page 38.)

With the lever and weight diaphragm loading system the accuracy will be about plus or minus 10% of the outlet pressure magnitude.

Where a higher degree of accuracy is required, and the outlet pressure

Recommended Diaphragm Size

Diameter Diaphragm Case	Size of Regulator	Delivery Pressure
11"	All High Pressure	2 to 10 pounds
9"	All High Pressure	10 to 30 pounds
7"	All High Pressure	30 to 50 pounds
5½"	All High Pressure	50 to 100 pounds
4"	All High Pressure	100 to 500 pounds

is to be less than thirty pounds, the pilot controlling system in Figure VI can be used. This system merely

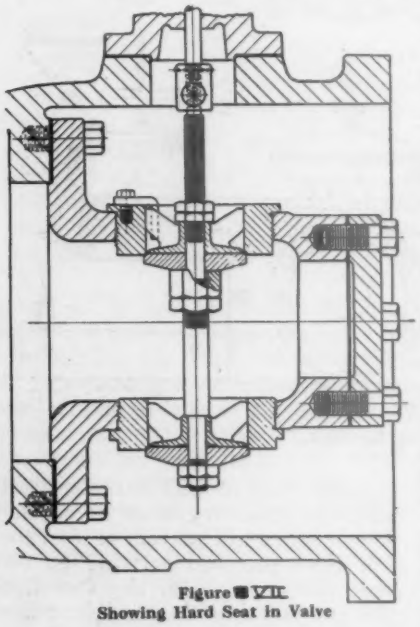


Figure VII.
Showing Hard Seat in Valve

applies two pilot regulators to the standard regulator with its lever and weight head. Its accuracy of control will depend on the accuracy of the final pilot controlling regulator, and should control to allow plus or minus two per cent accuracy.

The highest degree of accuracy for those ranges from two pounds outlet pressure to the highest will be obtained by using the pilot loading system shown in Figure V. For all ranges of outlet pressure the same main diaphragm head is used. In this system the pressure to be controlled is under the main diaphragm and acts upward against the pressure in the top half of the main chamber. This top half pressure is accurately controlled by a small regulator with a constant small flow through it. This small regulator is very accurately made and works under ideal conditions so that its outlet pressure, which is applied downward on the main diaphragm is very constant. Because the pressure differences across the main diaphragm is so small, (almost equal on both sides) a large diameter, thin diaphragm can be used. This large sensitive diaphragm responds very readily to changes in outlet pressure, hence a high degree of accuracy in control is obtained.

In this type of control, the small flow required to keep the pilot regulator operating satisfactorily, must either be led to a safe atmospheric outlet or to a point of low pressure—lower than the outlet of the main regulator. Accuracies within plus or minus one per cent can be obtained from this arrangement.

While the accuracy of pressure control is dependent on the diaphragm, the real work of the regulator in throttling is done by the valves. Most regulator designs for this work employ "balanced" valves, i.e., two valves of approximately the same diameter. Thus, when the valves are on or near their seat, the inlet pressure on one is applied in the opposite direction to the inlet pressure on the other, neutralizing the effect of inlet static pressure. A study of the direction of flow through the top and bottom valve, however, will reveal that although the static pressure of the inlet may be balanced, the dynamic force caused by the flow of gas from the high to the low pressure side is not balanced. The valve must, of course, resist abrasion of the gas and its included dust and dirt particles. Often times the velocity of the gas in passing through the valve is that of sound, (approximately 1100 feet per second), hence rapid wear might result. When large pressure cuts are met, these valves and their seats are usually metal, and are arranged as in Figure VII. Semi-steel castings are usually employed for this work but hardened steel seats and valves are also extensively used. In handling corrosive gases the various rust resisting alloys are often used.

Hard (metal) valves and seats are ground to a close fit with each other in manufacture, and will be practically tight initially. However, abrasion and dirt deposits will soon prevent this close fit, and in general hard valves can not be relied upon to effect a complete shut off of the gas after a short period of service. When a complete shut off is desired, that is, all flow stopped by the regulator in response to slightly increased outlet pressure, soft valves such as shown in Figure VIII are required. Here by using a soft material, coacting with a seat designed to press lightly into the material, a complete lock off can be obtained. The soft material is selected depending on the gas and the pressure cut taken. Rubber substitutes and leather, especially treated, are mainly used. For manufactured gas, Vim leather, impregnated, or paraprene, a newly developed rubber substitute, are most common. For natural gas, paranite or paraprene, both rubber subsitutes, are used. It is obvious that the soft materials are not as resistant to wear from velocity as the hard ones, but rubber and some of its substitutes are notably wear resistant, and soft valves often surprise in their lasting qualities. Where multi-stage reductions are used, it is possible to take the first and greatest pressure losses across hard valves, the last and controlling cut, where both accuracy and shut off count, through soft

(Continued on page 104)

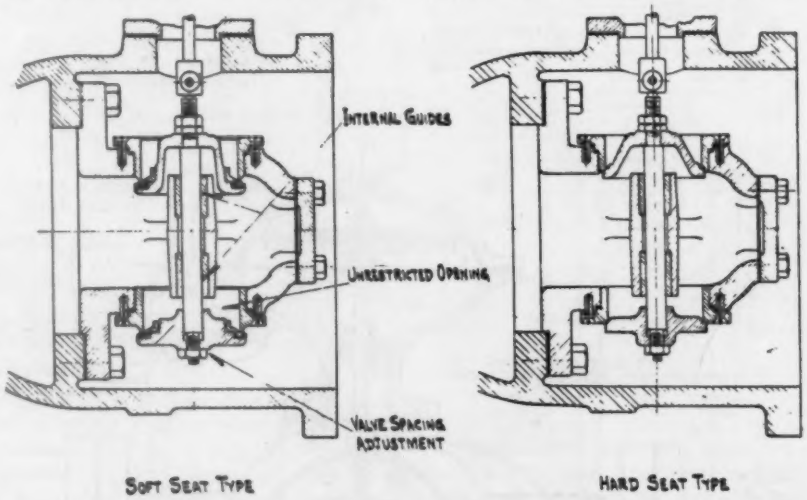


Fig. VIII
Soft Seat Valves—Internally Guided Type.

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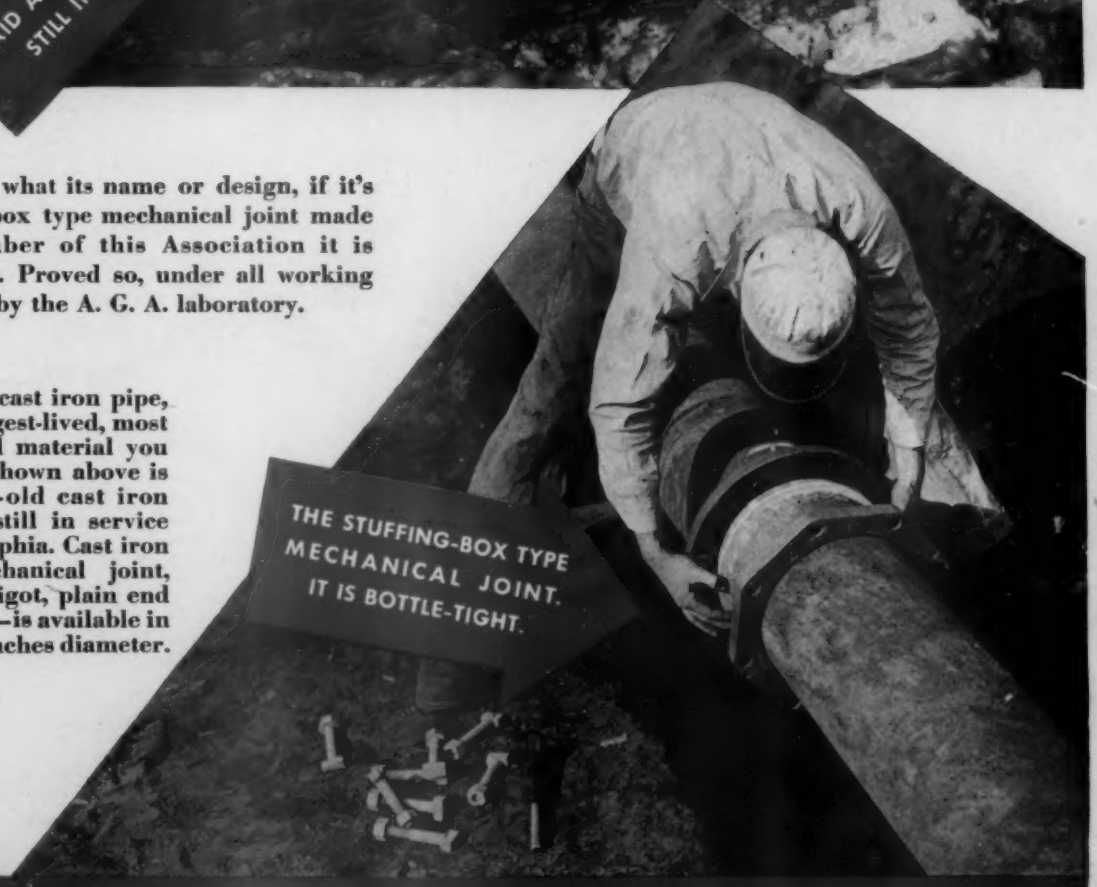

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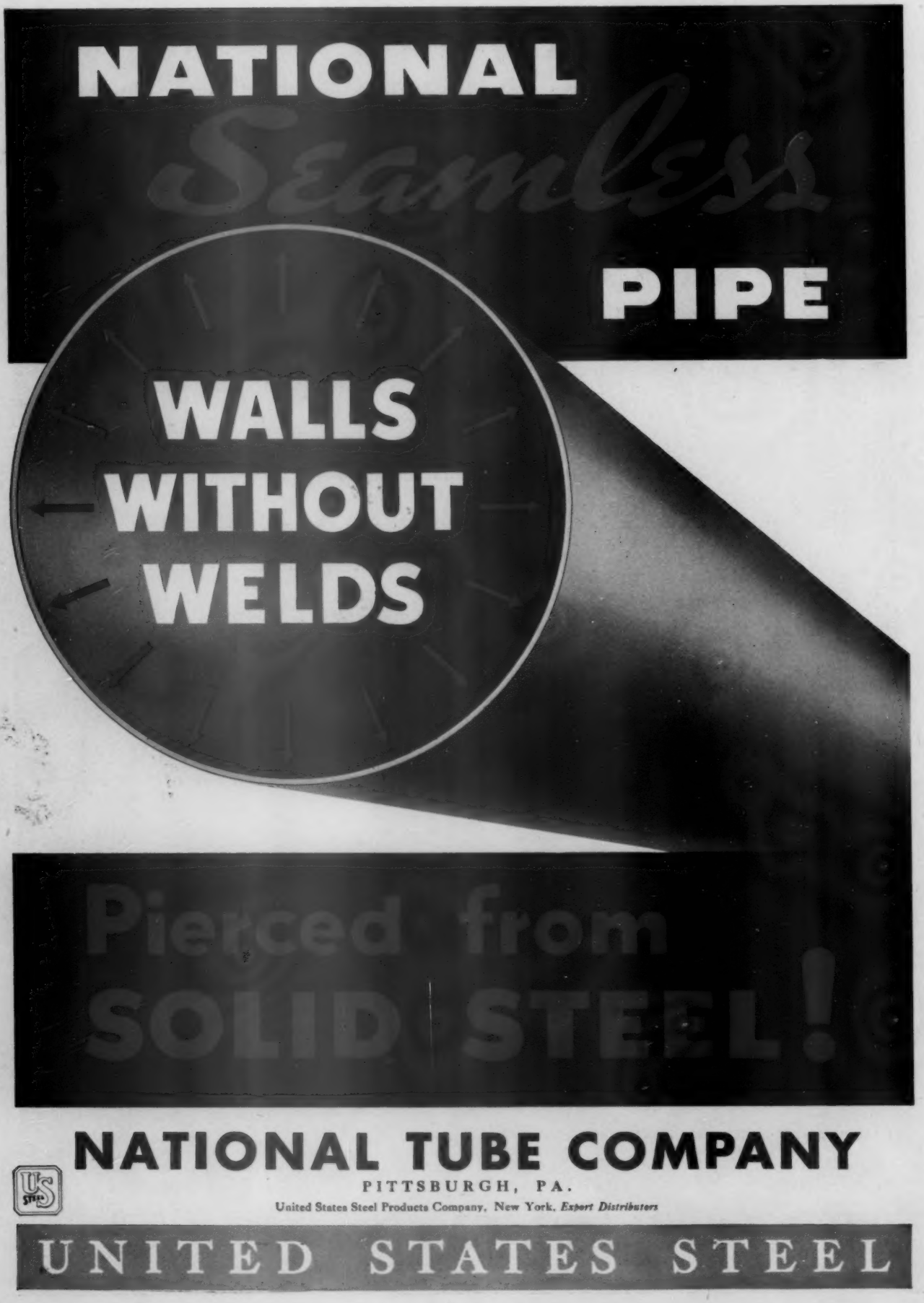

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Rules on How to Avoid Liability For Motor Truck Injuries

By Leo T. Parker

Attorney at Law, Cincinnati, Ohio

ALL gas companies utilize motor vehicles and naturally a common source of litigation involves injuries resulting from the operation of these vehicles. Therefore, it is interesting for the officials, managers, and employes of gas companies to know that recently the higher courts have rendered several important decisions, explaining various phases of the law, from which may be determined how to avoid liability for injuries caused by motor vehicles.

First, it is important to know that the courts have consistently held that the owner of a motor truck is liable for injuries sustained by a stranger who is permitted by the driver to ride, or for injuries sustained by others who are injured while rendering the driver assistance, providing the testimony indicates that the owner of the truck knew or, by the application of ordinary care, should have known that the driver was accustomed to permitting strangers to ride or render assistance.

If, however, the driver of a motor truck signs a contract in which it is agreed that he will not permit strangers or other persons to ride on the truck or render assistance and that he will use care when driving the truck, and the gas company officials exercise care to know that his driver abides by this agreement, the gas company may avoid liability for injuries resulting from failure of the employe to obey certain provisions of the contract.

After a careful review of recent higher court cases it appears that the decisions indicate that the chances of liability may be importantly reduced by gas company officials having their motor truck drivers sign a contract as follows:

"We, the undersigned, being employed by *(name of company)* hereby agree that we will not allow anyone to ride on your trucks at any time, other than authorized helpers. We realize that this is forbidden because such a person might be injured thereby and bring legal action against you. We have read the foregoing and shall abide by it. *(Drivers' and chauffeurs' signatures).*"

Also, it is advisable that gas company officials have small signs printed, as follows: "Riders keep off." One of these signs should be attached to the windshield and another to the rear end of the truck.

If a driver or chauffeur disobeys these instructions of his employer, the employer ordinarily is not liable. In other words, the majority of courts hold that where the driver of a motor vehicle disobeys instructions, the owner of the vehicle is not liable in damages for injuries caused by any person who is requested or permitted by the driver to drive or assist on the truck, and not a regular employe of the owner, unless the employer has knowledge that the driver is in the regular habit of disobeying the instructions. (165 Ala. 230.)

Another important point of the law is that where a driver has *not* been forbidden by his employer to permit children and other persons to ride on the vehicle, or assist in his work, the employer is likely to be held liable in damages for injuries inflicted on children who are permitted or invited to ride.

Scope of Employment

Various courts have held that gas company officials have the right to prescribe reasonable rules and regulations to be observed by employes for the safe and prudent operation of the business. So long as these rules are in force the employe is *not* acting within the scope of his employment when he invites children to ride, or when he undertakes, in direct violation of such rules, to employ assistance in the performance of his duties.

For instance, in the leading case of Goldberg v. Borden, 227 N. Y. 465, 125 N. E. 807. a higher court recently held:

"Where a driver, acting contrary to express orders, invites a boy to ride on a truck which is started so suddenly that the boy is thrown off and injured, the employer is not liable for the injuries."

The reason assigned for this holding is that when the driver invited the boy to ride in direct violation of the rules of his employer, such driver was wholly outside the scope of the employment.

Employer Has Knowledge

On the other hand, the law is well established that the owner of a motor truck is liable in damages for any injury caused a helper, or other person, who is permitted to assist the driver, although the latter employed the helper without knowledge of his employer, providing the employer has failed to forbid the driver to employ assistants, or the employer had knowledge that the driver had employed a helper.

For example, in the late case of Gas Company v. Stephens, 127 So. 668, it was shown that without knowledge of his employer the driver of a truck employed a young boy as a helper. The employer was informed of this fact.

Soon afterward the helper was injured. In holding the employer liable, the court said:

"The driver of the truck employed the helper to assist in delivery with the knowledge and consent of defendant (employer)."

Also, it is important to know that gas company officials are bound to exercise an ordinary degree of care to know that their drivers obey instructions. Failure to do so may be considered negligence on the part of the company which results in liability.

For illustration, in Hayes v. Pine State, 141 S. E. 340, it was shown that a driver permitted a boy nine years old to ride on his truck. The boy was injured and the company owner of the vehicle attempted to avoid liability on the contention that an official had instructed the driver not to allow children or other persons to ride. Nevertheless, the court held the company liable in $8,500 damages, since it was shown that the

driver had been in the habit of permitting boys to ride and the official *had not exercised care to know* whether or not the employe was obeying instructions. This court quoted the law, as follows:

"It has been held generally that if a rule is made for the safety of the servant or others, but its customary violation has continued so long that the master either knew of it, *or could by the exercise of ordinary care have found it out* and acquiesced in it, he is presumed to have consented to its repeal, or to have waived obedience to it."

Driver Takes Vehicle Home

It is settled law that a gas company is not liable for injuries effected by a motor truck driver under circumstances where the latter is not acting within the actual or implied scope of the employment at the time of the accident, as where he takes the truck for his pleasure or business purposes, without authority, or where he disobeys his employer and substantially deviates from the direct route to the place where he is instructed to go.

Whether the gas company is liable for injuries caused by a driver outside regular business hours depends upon the answer to the question: Was the driver acting within the scope of the employment when the injury occurred?

For instance, in Primos v. Gulfport, 128 So. 507, it was disclosed that a driver took a motor vehicle home, and at night used it to take his wife to a dance. While returning to his home he collided with another automobile whose occupants sued the driver's employer for damages.

After reviewing the testimony the higher court, states the following important law:

"If File (driver) attended the dance merely for the pleasure of himself and his wife, he was not authorized to use the vehicle in going to and returning therefrom. But if he attended the dance solely for the purpose of soliciting business for the appellee (employer), then he was within the scope of his employment. . . ."

Moreover, some courts have held that a gas company is not liable for an injury negligently effected where it is shown that the driver disobeyed the instructions and did not take the route he was ordered to take. In fact any disobedience of a driver may relieve the company from liability.

Inspection Relieves Gas Company

In all cases involving injuries caused by motor vehicles the consideration is whether the party being sued had frequently inspected the thing alleged to have resulted in the injury.

For example, in Nelson v. Signal Gas Company, 51 Pac, (2d) 885, it was disclosed that a passenger vehicle collided with a trailer owned by a gas company. The driver of the passenger vehicle was killed and his dependents sued to recover damages contending that when the collision occurred there were no tail lights on the trailer.

During the trial it was proved that the trailer was equipped with two taillights situated on the chassis and a light fastened onto the extreme rear of an overhanging pipe. Repeated inspections were made of these lights by the truck driver from the time they left on the trip to a point approximately two miles prior to the scene of the accident. On each of these occasions the lights were observed to be burning brightly.

The court instructed the jury as follows:

"If in this case you find that the defendant (gas company) made a reasonable inspection of the rear or taillights on said truck and trailer and exercised due care to determine that said taillights were in fact burning, then you are instructed that the defendants were not guilty of negligence in this particular even though the rear or taillights were out when the collision occurred."

In view of these instructions the higher court held the gas company not liable.

Few drivers realize that negligence in driving a motor vehicle, which results in an injury to another, may result in the driver being *personally* liable in damages to the injured person. Therefore, if vehicle drivers are informed of their personal responsibilities for injuries caused by negligent driving, there is little doubt but that the knowledge thus imparted will result in their exercising a higher degree of care to prevent accidents.

For example, in a leading case (218 N. Y. S. 536) it was disclosed that a gas company driver was held personally liable in damages for negligently driving the vehicle in collision with a pedestrian and inflicting serious injury. The court said:

"It is elementary that a tort-feasor (negligent driver) is liable for any damage, even though he may not be the owner of the automobile, the operation of which causes the damage. It is sufficient that he operates it in a careless manner to charge him with liability."

Also, in another case (217 N. Y. S. 261), a driver negligently collided with a passenger automobile seriously injuring its occupants, who sued the negligent driver and recovered a judgment for $500.

Instruct Your Drivers

The law is well established that certain acts of a vehicle driver always results in liability of his employer. A review of recent higher court cases discloses that the courts have held gas companies liable for

"To drivers of company: In order to minimize your own personal liability, as well as your employer's, for injuries caused by operation of your motor vehicles, the most recent higher court decisions have been reviewed from which it is determined that you can reduce chances of law suits by abiding by rules, as follows:

(1) Keep over well to right side of street;
(2) Never pass another vehicle at a curve;
(3) Don't race for intersection;
(4) Park disabled vehicle off highway, if possible;
(5) Keep headlights non-glare;
(6) Always keep vehicle under control;
(7) If foggy or slippery be ready to make emergency stop;
(8) Don't speed up when another vehicle attempts to pass you;
(9) Keep in driving lanes;
(10) Remember you are driving a dangerous vehicle;
(11) Keep your lights and brakes efficient at all times;
(12) Look before backing up;
(13) Signal and look before making a turn;
(14) Don't pick up riders;
(15) Keep to right when driver in rear blows his horn;
(16) Pull to curb when fire department or other emergency vehicle approaches;
(17) Always park close to curb;
(18) Be careful, although another driver is violating a traffic regulation.

Heavy damages were awarded by different courts as a result of failure of drivers to follow each of these rules. Study and know these rules. Yours truly, (name of employer)."

injuries effected by their drivers under various circumstances. Therefore, in view of these decisions officials of gas companies will do well to prepare a printed or typewritten sheet, as illustrated.

Last Clear Chance Doctrine

An important phase of the law of injuries is termed the "Last Clear Chance Doctrine." It means that a person who has the last chance to prevent an injury, and fails to exercise ordinary care to take advantage of the opportunity, is responsible for the occurrence of the accident, irrespective whether the other person's negligence resulted in the original situation. In other words, by this rule of the law the person whose negligence to act when he could have acted to prevent an accident is *wholly* responsible for the resultant damages.

For illustration, in the late case of Spahn v. Shrewsbury Company, 130 So. 837, a boy who was coasting in a small wagon on a highway observed a motor truck approaching and he stopped his wagon in the middle of the highway. The truck driver without abating its speed of approximately 30 or 35 miles per hour, continued to approach and collided with the boy's wagon. In holding the driver responsible for the accident, this court said:

"It is evident that the driver had the last clear chance of avoiding the accident. . . . Whatever may have been the negligence of plaintiff's son in driving upon the highway . . . there was ample opportunity for the driver to have avoided the accident."

Therefore, irrespective of another person's negligence, although he may be violating a traffic law, any person who could have prevented the injury, and did not do so, is liable in damages.

Gas Company Employees Honored for Long Service

New Compressor and Booster Units Named in Ceremonial at Elizabeth, N. J.

THE idea of honoring long-term employees of the Elizabethtown Consolidated Gas Co. by naming compressor units after them was conceived during the conversion of their old purifier plant into a large, well lighted and ventilated addition to the old engine room. Four employees, each in the service of the Company for more than 40 years, were so honored on September 16 by a brief but impressive ceremonial at the Erie Street plant, participated in by officials of the Company and plant employees.

The honored employees were Francis F. Engel, vice-president of the Company; John Manhardt and Robert Burns, engineers, and the late Roger Crilly, who was superintendent of the Erie Street plant.

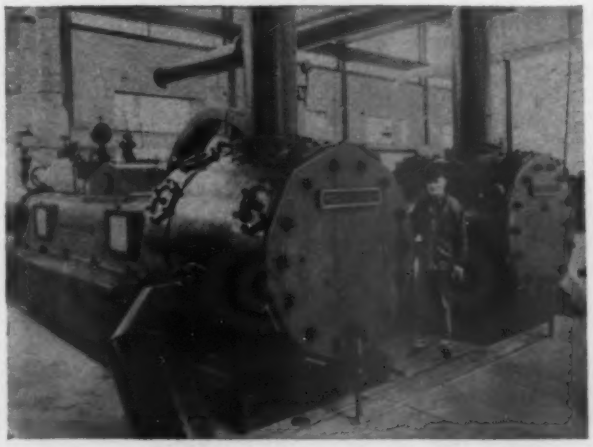
In a brief address, John J. Crilly, son of the last named, and present superintendent, explained that the compressors were being named for the employees in recognition of their long service and loyalty to the Company and that their untiring devotion to duty will not be forgotten for many years to come. He then introduced Captain John Kean, President of the Company.

Captain Kean expressed appreciation of the work of the four and described them as "friends." He said he spent several months in the Erie Street plant 26 years ago and during that time he came to know the employees who were honored today. He then cut blue ribbons on the four compressors which bore large bronze name-plates and named each machine.

Captain Kean then introduced Mayor Joseph A. Brophy. The Mayor, in the course of an inspiring address, told his audience that the honor paid the four men is something money cannot buy. He also spoke of the "many benefits this city has derived from having this company within its boundaries."

Mr. Francis Engel started to work for the Company in 1872 and has given 64 years of unfailing service since that time. He, with Roger Crilly, has worked many years on different Company problems. Mr. Engel, at his hearty age of 84, still reports to work daily at the gas office. One of the larger compressor units is named for him. This unit will pump one million cubic feet of gas per hour and stands beside the compressor named for Roger Crilly.

The late Roger Crilly, superintendent of production at the plant of the gas works until a short time before his death in February, 1935, started work for the Company in 1889, and held the post of superintendent of production for more than



Principals at the dedication ceremonial: Left to right, Henry W. Crane, Asst. Treas.; John Manhardt; William S. Potter, Treas.; Francis Engel, Vice Pres.; Capt. John Kean, President; Robert Burns; Hon. Joseph A. Brophy, Mayor of Elizabeth; John J. Crilly, Supt. of Manufacture.

40 years. The unit which bears his name plate is the latest compressor installed in the plant.

Robert Burns and John Manhardt have been closely associated in the work at the gas plant for more than 40 years. They worked on opposite shifts and their faithful service has been responsible for the continuous and efficient operation of the engine rooms. Two of the other units in the plant now bear their name plates.

When Burns and Manhardt started work for the Gas Company, compressors were of 15 to 20 horsepower. They have seen the plant grow from such small units up to the present capacity units of 690 h. p.

The site of the new engine room was originally an old generator house, later used to house some cast iron purifiers. About two years ago the need for more room necessitated erecting new purifiers in a new location. The building was stripped and remodeled as a new steel and brick structure, abundantly lighted, and equipped with a 10-ton overhead traveling crane. All new gas piping was put in which called for the laying of about 600 feet of 36-inch pipe with valves and connections, and tearing out the old 20- and 24-inch piping, the 36-inch pipe taking its place. The time required for this project was about 10 months, using the Gas Company's force.

One Ingersoll Rand cross compound steam driven compressor was installed with a piston displacement of 7,360 cubic feet per minute, this engine being built to pump against a pressure of 30 pounds per square inch. This engine was named after former superintendent, Roger Crilly. A DeLaval steam turbine driven booster having a free gas capacity of 16,700 cubic feet per minute, discharge pressure being 10 pounds, also has been installed. There is additional space for piping connections and three other boosters of this type, also two engines of the former type.

As other machinery is installed in the plant, bronze plaques in honor of other long-term employees will be dedicated.

Among other Company officials who witnessed the dedication of the machines were William S. Potter, treasurer; Henry W. Crane, assistant treasurer; William S. Aiken, purchasing agent; Frank A. Engel, superintendent of distribution, and Denis J. Mannir.g, assistant superintendent of distribution.

After the ceremonies, all the officers made an inspection tour of the plant.

Revised Standards for Semi-Rigid Tubing and Fittings Completed

MANUFACTURERS of gas ranges, central heating gas appliances, space heaters, and hair dryers, as well as manufacturers of semi-rigid tubing and fittings, will be interested to learn that revised American Standard Listing Requirements for Semi-Rigid Gas Appliance Tubing and Fittings have been approved and will go into effect on January 1, 1937. This matter is of considerable importance inasmuch as the approval standards on the basis of which gas ranges, space heaters, boilers, furnaces, and hair dryers will be tested by the American Gas Association Testing Laboratories after the first of next year, all require that any semi-rigid tubing and fittings used in appliance construction be capable of meeting the American Standard Listing Requirements for same as regards both construction and performance.

In the case of gas ranges, the effective printed standards already specify listed semi-rigid tubing and fittings, although special action has provided for a waiver of the performance demands until January 1 when the revised tubing and fittings listing standards become effective.

The tubing and fittings listing requirements to be applied after January 1 are substantially the same as those which were developed some time ago and have been approved as American Standard, though unprinted, for over a year. However, after the American Standards Association approved the first Listing Requirements for Semi-Rigid Gas Appliance Tubing and Fittings in February, 1935, there were raised several points which required disposition before actual tubing testing for listing purposes could begin. These points concerned: (1) The relative acceptability for gas appliance usage of flared, compression, and soldered types of fittings; (2) the degree of agreement between the required fitting dimensions and tolerances and the corresponding S.A.E. dimensions and tolerances; and (3) the durability and performance of fittings and tubing ends under the strain of connection and reconnection. All three matters were, hence, investigated, and appropriate new and revised clauses proposed by the subcommittee for incorporation in the existing standards. The A.S.A. Sectional Committee, Project Z21, A.G.A. Approval Requirements Committee, has now adopted all these recommended revisions, and decreed that the revised requirements shall become effective on January 1 next.

Both compression and flared type fittings, but not soldered fittings, will be acceptable; fittings must be S.A.E. standard or equivalent; and in addition to other tests, fittings will be subjected to a tightening, deflecting, releasing, and reconnecting test repeated five times to insure reasonable durability in service.

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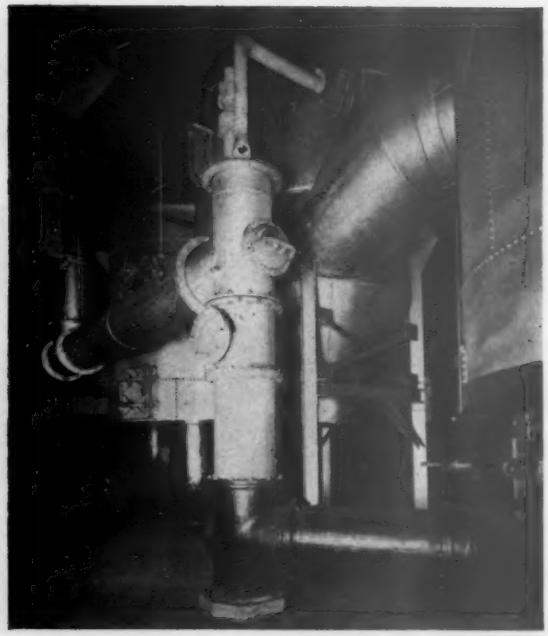


Reverse Flow Water Gas Set Installed at Springfield, Mass.

(By Staff Correspondent)

To the left: View of the machine from the clinker floor, showing the generator, elevated carburetor and the tangential connection between the generator and carburetor, with the gas entering the bottom of the latter. At the rear is the super-heater. In the foreground is the backrun piping.

RADICAL departures from the time honored design of the Lowe water gas set are incorporated in the "Reverse Flow" machine recently developed by the Semet-Solvay Engineering Corporation. The first installation has been made at the plant of the Springfield (Mass.) Gas Light Company, where a 10′ 6″ set has been rebuilt to provide for counter current flow of gas and oil in the carburetor and down flow of gas in the superheater. The necessity of supplying virtually the entire sendout from the coal gas plant so as to build up a stock of coke for the winter demand has thus far limited the operation of the water gas set to a relatively few hours. However, both the company management and the manufacturers have been well pleased with the performance thus far.

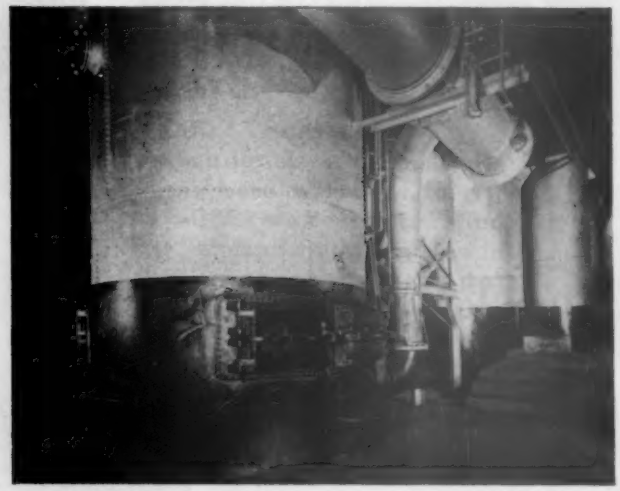
On the opposite page is a plan and elevation of a Semet-Solvay reverse flow water gas set. It is a three-shell machine, having the conventional generator, an elevated carburetor and a standard size superheater. The generator take-off runs to the *bottom* of the carburetor. The carburetor outlet is at the top and runs to the *top* of the superheater. The superheater outlet is at the bottom and a riser pipe connects to the stack valve and the three-way backrun valve. The backrun pipe extends from the base of the generator to the backrun side of the three-way backrun valve. The backrun valve is located above the washbox as in normal practice.

Near the bottom of the carburetor, supporting tile are installed to support three or four rows of standard checker-brick. The superheater is filled with the normal number of checkers. An oil spray is installed in the top of the carburetor. An additional spray is installed in the top of the generator for heavy oil operation.

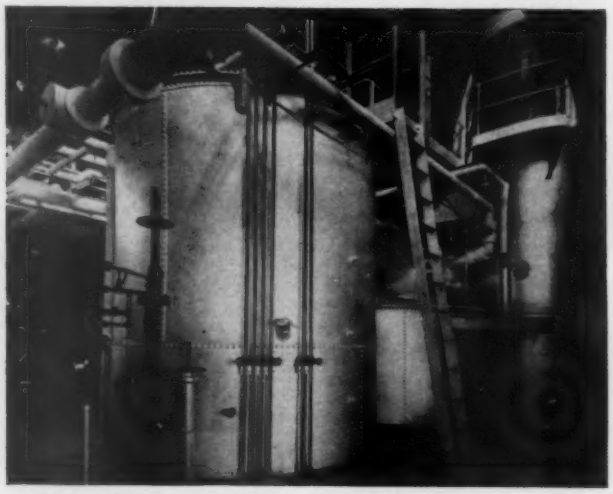
The operation of the reverse flow set is as follows:

Blow Period:

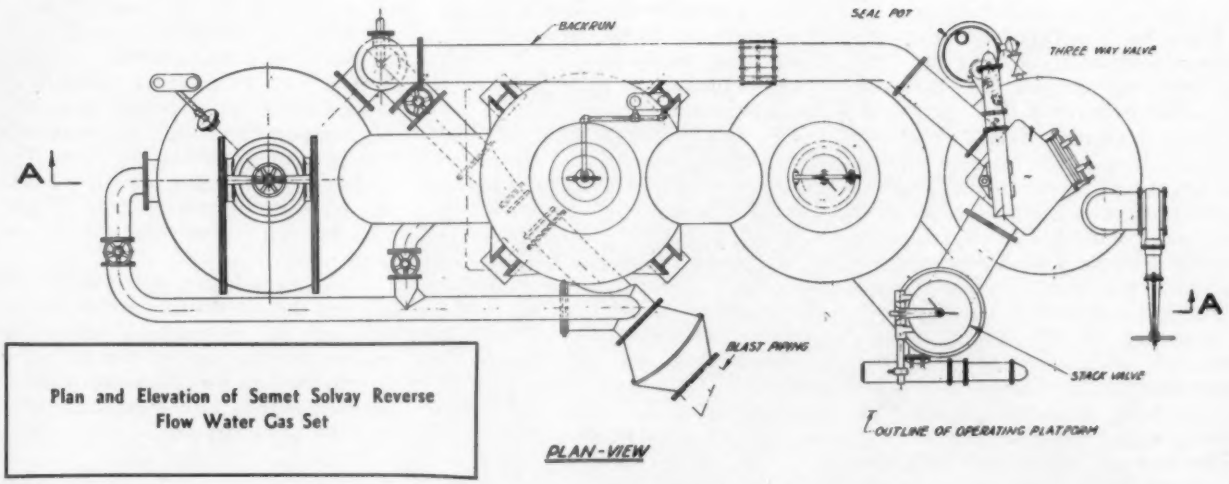
Primary air is admitted at the base of the generator as usual and passes up through the fuel bed. Secondary air, to complete combustion of the blast gases, is admitted in the connection between the generator and carburetor, or in the top of the generator as desired. Combustion now takes place in the bottom of the carburetor, heating the checkerbrick grate, making this zone the hottest zone in the machine. The tempera-



View taken from the clinker floor. This picture shows the generator, air supply header and generator blast valve and piping. The carburetor is shown and the superheater, stack connection and stack.



View from the operating floor. The elevated carburetor is in the foreground. The connection between the carburetor and superheater is shown, and beyond it, the stack and stack cap.

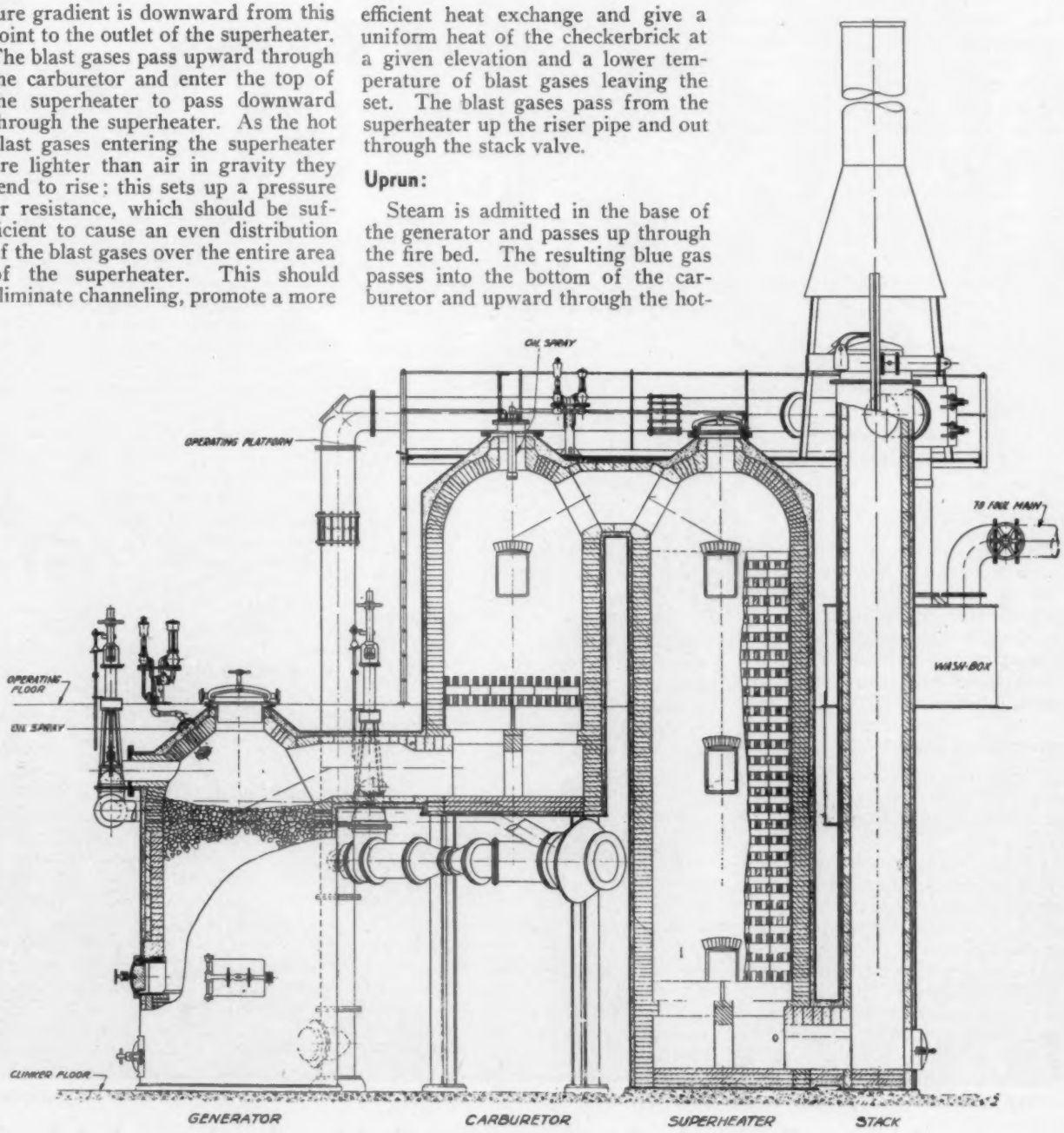


Plan and Elevation of Semet Solvay Reverse Flow Water Gas Set

ture gradient is downward from this point to the outlet of the superheater. The blast gases pass upward through the carburetor and enter the top of the superheater to pass downward through the superheater. As the hot blast gases entering the superheater are lighter than air in gravity they tend to rise; this sets up a pressure or resistance, which should be sufficient to cause an even distribution of the blast gases over the entire area of the superheater. This should eliminate channeling, promote a more efficient heat exchange and give a uniform heat of the checkerbrick at a given elevation and a lower temperature of blast gases leaving the set. The blast gases pass from the superheater up the riser pipe and out through the stack valve.

Uprun:

Steam is admitted in the base of the generator and passes up through the fire bed. The resulting blue gas passes into the bottom of the carburetor and upward through the hot-



test zone. At the same time, gas oil or heavy oil is sprayed into the carburetor downward to meet the blue gas traveling upward thus utilizing the counter current flow principle. As the oil gasifies it is carried off with the blue gas. The oil that is still ungasified passes further on into the atmosphere of hot blue gas and as it is traveling downward, continually enters a hotter zone until it reaches a temperature high enough to gasify it completely. The principle of gasifying oil by passing it into zones of progressively increasing temperatures would seem to be correct and to be a distinct advance over existing water gas practice.

The blue gas and oil gas pass into the top of the superheater and then down through a uniformly heated checkerwork where they are fixed. They then pass out and up the riser pipe to the washbox.

When using heavy oil for carburetion, a carbon residue is left which will be deposited in a thin layer on the checkerbrick near the bottom of the carburetor. As this is the zone of highest temperature, the carbon temperature will be high. During the backrun some of this carbon will react with the steam and be carried to the generator as CO or CO_2 gas. During the blow period the rest of the carbon should be consumed and the machine kept clean. The burning of the carbon during the blasting period will furnish part of the heat necessary to maintain the carburetor and superheater at proper temperature.

Backrun

The function of the backrun is the same in the reverse flow set as in any standard backrun machine. However, with the new design, back run steam is admitted at the *bottom* of the superheater and passes upward. It then passes down through the carburetor into the top of the generator.

Improvements Sought

In designing the reverse flow water gas set the manufacturers had certain definite objectives in mind. These were:

(1) A more uniform distribution of heat in the carburetor and superheater, with the hottest zone correctly located in the carburetor to give the best oil efficiency.

(2) Counter current flow of blue gas and oil fog, with the oil passing into progressively hotter zones until gasified and then being removed to a proper fixing temperature with a minimum of opportunity for overcracking, and carbon deposition.

(3) Complete combustion or gasification of any carbon deposited even when using heavy oil.

(4) Elimination of channeling in the superheater.

(5) Lower temperature of blast and uprun gases leaving the superheater, a condition which should tend toward improved full efficiency.

The Springfield set has not yet been operated long enough to prove definitely how far the expectations of the manufacturers will be realized in practice. However, there have been certain preliminary indications. The capacity of the set substantially exceeded that generally secured from sets of comparable size. Fuel and oil results apparently were good but the period of operation was too short to permit any real conclusions to be drawn. It was found possible to maintain the set at proper gas making temperatures with an unusually low percentage of blasting time. The set handled and satisfactorily gasified any quantity of gas oil up to 75 gallons per run. Heavy oil has not yet been used.

The gas industry will await with interest the results of further operation of the Springfield set. Our readers may be assured that they will be reported in the JOURNAL as soon as they permit any significant conclusions to be drawn.

Book Reviews

Pipe Coating Specifications for Field Application prepared and published by The Barrett Company, New York, 1936. 80 pages with numerous illustrations.

There is a great lack of definite information on how to coat pipe properly in order to prevent corrosion. A coting may be applied in a haphazard way, and the pipe may not corrode — because the soil is noncorrosive. The construction man believes, however, that he had done a good coating job. On the other hand if corrosion does take place, the chances are that he blames the coating material rather than the method of application.

This book tells specifically and in detail how to apply coating properly. To be sure it refers to Barrett materials, but the same directions are quite generally applicable.

The subjects covered include mill priming, handling coating materials, cleaning the pipe, application of primer in the field, application of enamel and the various ways of doing so, flux, coating couplings, inspection, whitewashing and shielding (wrapping).

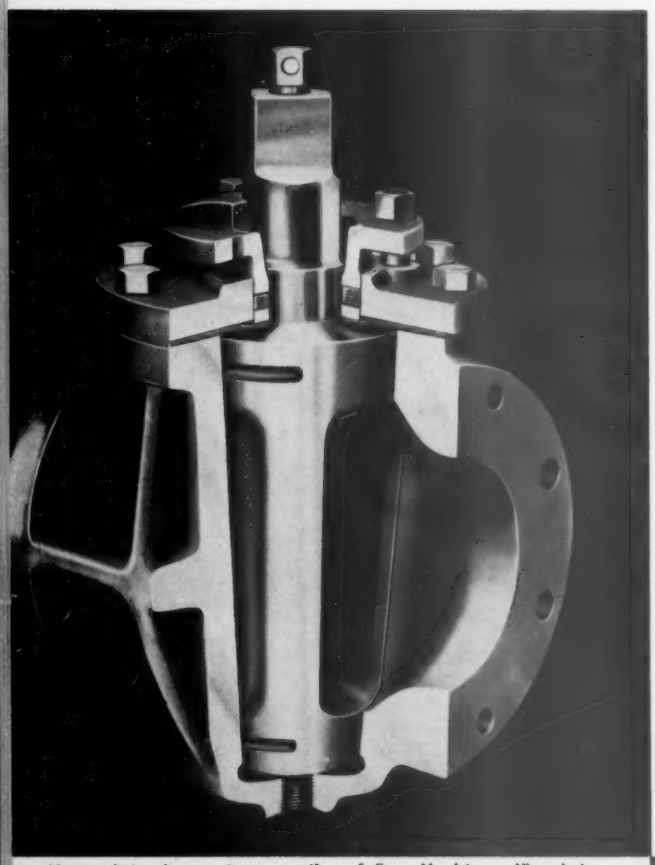
Public Utility Industries by G. Lloyd Wilson, James M. Herring and Roland B. Eustler. 412 pages. The McGraw-Hill Book Company, Inc., 1936. Price $3.50. The purpose of this book is to present descriptive and factual data necessary to an understanding of the nature and characteristics of the various classes of public utility companies. Following a general discussion of the characteristics of public utilities and a particularly able chapter on the principles of rate making, the volume treats successively the economic features, organization, functions, services, rate structures and policies of the manufactured and natural gas industries, the electric light and power industries, the water supply industries, the motor transportation industries, urban street car and rapid transit industries, and telephone, telegraph, cable, and radio communication industries. A final chapter deals with the nature and significance of the trends toward the consolidation and combustion of utilities.

The authors, two of whom are professors at the University of Pennsylvania and the third a professor at the University of Florida, have handled their subject thoroughly and impartially. To a great extent the presentation is factual, and the authors evidently intend it to be the foundation for a further study of controversial public utility probems. The basis is well laid, and all students of utilities and their relations with the public should find this book of real interest and value.

Metric Conversion Tables, Second Edition published by West Gas Improvement Co. Ltd. 424 Madison Ave., New York, N. Y. and Manchester, England. 46 pages. This is a handy little volume containing factors and tables which enable rapid conversion of both simple and compound weights and measures from Metric into English units or vice versa. The needs of the gas industry have been kept particularly in mind in compiling it. Those who make it a practice to read European publications or for one reason or another have reason to make use of Metric units will find it very useful.

"Gosh! I wish they'd buy more of these Emco-Nordstroms"

PERFECT APPLICATION OF A PRINCIPLE



Above photo shows cut-away section of Emco-Nordstrom. View below shows standard Nordstrom Valves, 12", 14" and 16" sizes, on gas lines in a scrubbing plant.

EMCO-NORDSTROMS are fast replacing ordinary valves on low and high-pressure gas lines.

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FOREVER EASY TO TURN THESE LUBRICATED VALVES

Valves in gas lines sometimes are not turned for a period of many months. But when an emergency arises and you want quick action, how embarrassing if the valve is tightly stuck and can't be "budged." Any Nordstrom Valve will turn easily even if it is not operated for years. Should the plug stick, give the lubricant screw a few turns and the plug will easily turn. And more important, any Nordstrom Valve will keep a tight seal, cutting unaccounted-for gas losses to the irreducible minimum and assuring greater safety.

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Internal Treatment of Mains as a Leakage Deterrent*

By Edwin L. Hall

United Gas Improvement Company, Philadelphia, Pa.

Gas Distribution Systems

THE typical low pressure gas distribution system is of cast iron bell and spigot pipe. The joints of the main are caulked with jute and lead or cement, or a combination of lead and cement. In recent years, a caulked joint containing some form of rubber ring, such as the Wedgetite, or mechanical joints with rubber rings have been generally accepted. However, most low pressure distribution systems consist very largely, and in fact almost entirely, of mains that were installed when jute and lead or cement were the accepted caulking materials.

That these lead or cement joints were good joints when installed is proven by the history of thirty to seventy years of trouble-free life of most of these mains. So long as the gas in the mains was supersaturated and plenty of "drip" was present for keeping the jute saturated, these joints were tight at the low pressures used.

It is well know that lead makes a tight joint only as long as there is no movement at the joint, for the lead is quite inelastic and once disturbed it takes a permanent "set" allowing some thin space between itself and the bell or spigot as the case may be. Normally, this space is between the spigot and the lead.

Many distribution engineers prefer the cement joint. They maintain that the bond between the cement and the iron is practically never broken. That they do not mean this literally, however, is shown by their reluctance to increase the pressure on these mains. If the bond were unbroken certainly 50 pounds would be a reasonable pressure to carry on these joints. What they do mean is that the space between the cement and the iron in the joint is normally very small and the leakage, if it exists, due to dry gas is so slight at each joint that no complaints arise, or that the damp earth around the joint prevents gas leakage.

When installing new mains these troubles can be avoided by the use of mechanical or Wedgetite joints. To repair an old joint a bell face clamp, which is simply the best mechanical joint that can be installed on a line in service, is usually used.

In recent years the introduction of improved gas cleaning apparatus in manufacturing plants and the distribution of mixed gas or natural gas in many localities has resulted in the distribution of a gas that is not saturated with condensate. This gas tends to dry out the main and the jute in the joints so that many mains that formerly were tight are causing some concern today.

In most localities the gas distribution system has grown until the original method of delivering gas through low pressure mains by holder pressure is no longer feasible. High or intermediate pressure transmission mains delivering gas through governors to the low pressure distribution mains have been developed. The gas that is delivered through a governor is not saturated with condensate.

When natural gas is used for mixing with other gases or is introduced into a system that formerly delivered manufactured gas, an unsaturated gas is produced that will tend to dry out the distribution system.

This problem has been recognized by gas distribution engineers who have attempted to control the dust troubles and leakage problems of dry joints by the rehydration of the gas and by oil fogging.

These methods are difficult to apply in outlying governor pits and where applied at one central point there is no assurance that either the water or the oil will condense and precipitate at the required locations.

Despite these difficulties many gas distribution systems have utilized rehydration and oil fogging systems with considerable success. The unaccounted for gas can be kept down by the continuous and judicious use of such systems.

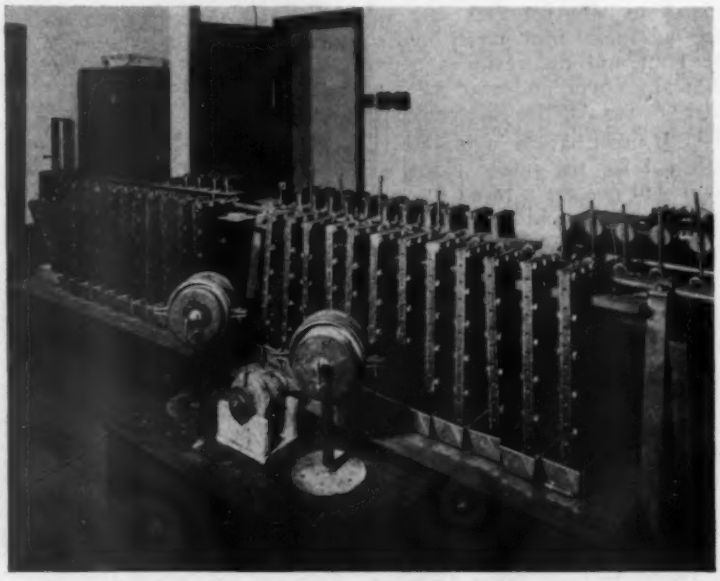

Exhibit 1

**Presented at the Mid-Year Meeting of Maryland Utilities Assn., Sept. 12, 1936.*

However, there are many locations where it has not been convenient either to re-hydrate the gas or to use oil fogging, and other cases where, after joints have become dried out, it has not been possible to resaturate them with either water or oil.

Solutions for Treating Mains

Mr. George E. Hitz of Poughkeepsie, N. Y. was confronted with this problem and decided that the method of pouring a liquid into the high point of a main and permitting it to run to a drip was a more positive method of treating any one section of main than the use of fogging equipment.[1]

Obviously, however, if water or a volatile oil is used this treatment must be continuous. It therefore seemed desirable to obtain a fluid that would swell the jute and remain in the joint over a long period of time.

The desirable properties of such a solution may be listed as follows:

(1) It should not be volatile. The liquid must have a low vapor pressure to avoid its loss by evaporation in the gas stream. This automatically eliminates water, the volatile alcohols and the volatile organic acids, all of which are known to be quite readily absorbed and to cause swelling of cellulosic materials.

(2) The solution should flow easily (low viscosity) so that it will travel readily through the main, and diffuse rapidly through the capillaries of the jute packing material.

(3) The solution should be miscible with water, tars, oils and gums since the main and the jute packing usually contains one or more of these four constituents. The gum and tar residues often practically cover and seal the exposed portions of the jute packing.

(4) It must have a high wetting coefficient for the jute packing so that it will possess a rapid rate of "climb" in the packing material.

(5) The solution should swell the jute fibers to the same degree as water, to fully compensate for the shrinkage caused by dehydration of the packing.

(6) The solution must not be corrosive to iron and preferably should inhibit corrosion.

(7) The solution should not congeal or freeze at low temperatures.

(8) The solution should be hygroscopic in order to facilitate the retention of such water as may be present in the joint.

(9) It should not be prohibitive in price.

Many pure and mixed liquids were tried before a solution was found whose characteristics proved reasonably satisfactory on all of the above counts.

In order to develop a satisfactory solution for treating the jute in bell and spigot joints a very comprehensive laboratory program was inaugurated and a search made of all materials or compounds which appeared in any way suitable for the purpose. The following is a broad classification of chemical types including among others in the laboratory phases of the investigation,—water, aliphatic acids, mono- and polyhydric alcohols including aromatic alcohols and alcohol ethers, aliphatic aldehydes including aromatic aldehydes; amines including aromatic amines; aliphatic esters including aromatic ethers, hydrocarbons, and various mixtures of these types.

Exhibit 2

Among the materials investigated for illustration were water, oleic acid, octyl alcohol, ethylene glycol, glycerine, ethylene diglycol, carbitol, butyl carbitol, cellosolve acetate, butyl cellosolve, methyl amyl cellosolve, phenyl cellosolve, mono-ethyl ether triglycol, benzyl alcohol, octyl aldehyde, benzaldehyde, pyridine, quinoline, tar bases, amyl acetate, amyl stearate, diglycol laurate, diethyl phthalate, olive oil, cottonseed oil, fish oil, lard, monethyl benzene, triethyl benzene, spindle oil, fuel oil, and various mixtures of these and other materials.

No single material was found to possess all of the desired properties. Some were too volatile. Some were too viscous. Some lacked climbing ability, and some failed to swell the jute fibers, or the swelling was insufficient to restore the packing to its original hydrated volume. A few such as ethylene diamine were found to cause serious disintegration of the jute fibers and are therefore dangerous.

One interesting bit of laboratory technique was a method used to determine the swelling of individual jute fibers by different liquids. Water causes an expansion in dry jute fibers of 44%. *Carboseal also causes a swelling of 44%. Certain mineral oils cause a swelling of but 14% while coal tar bases cause a swelling of 0%. The swelling range is therefore from 0 to 44%.

In order to determine this volume increase for each unknown liquid micro-photographs, all of the same magnification, were obtained of the cross-section of the jute fiber before and after treatment. The outlines of these micro-photographs were then traced on thin transparent paper and cut out from the paper. The paper

[1] *"Experience in Leak Proofing Bell and Spigot Joints" by G. E. Hitz, American Gas Journal, April, 1936.*

* *Manufactured and sold by Carbide and Carbon Chemicals Corp., 30 E. 42nd St., New York.*

outlines were then weighed and the relative increase in the weight of the paper was a measure of the increase in cross-sectional area and hence of the volume of the jute.

After these preliminary laboratory tests permitted a selection of the most promising materials and compositions, various physical tests were inaugurated in order to determine which of these compositions would be most promising under practical service conditions.

The first tests of these compounds were made with actual bell and spigot joints after removal from service. It soon became apparent, however, that differences in the joint structure were more significant in many cases than the differences in the compositions being tested. In order to avoid these discrepancies, a set-up, such as that shown in Exhibit 1, was made for testing the various solutions. Artificial joints, such as shown in Exhibit 2, were made from boiler plate and into these joints, jute pieces of uniform character were compressed under a uniform load and finally caulked into place with lead. This method gave uniform test pieces which could be immersed in various solutions, as shown in Exhibit 1, for testing purposes. Holes for ¼" pipe were drilled and tapped in the spacer piece at 2" intervals in order to determine the rate of solution rise in the sample. This rate of solution rise was determined in two ways:

(1) The electrical resistance of the jute was measured by inserting a needle electrode through one of these holes and measuring with a Wheatstone bridge the resistance drop from the boiler plate casing to the tip of the needle, a distance of ¼". The magnitude of this resistance was of the order of 10 megohms if the jute was air dry. As soon as the jute became wetted by any of the liquids (except the oils) the electrical resistance fell to values of the order of a few tenths of a megohm.

(2) The rate of gas leakage through the packing was measured directly as follows: A nipple was inserted into one of the holes and connected to a supply of gas at 4.5" pressure. When the jute packing was dry the leakage was of the order of ½ to 1 cu. ft. per hour, the gas issuing from the adjacent holes. As soon as the jute became wetted with the solution, the leakage gradually became smaller and finally ceased. The gas leakage end-point was not reached simultaneously with the drop in electrical resistance at any given level, due to the fact that complete saturation was required to prevent gas leakage, whereas a small trace of liquid would affect the electrical resistance.

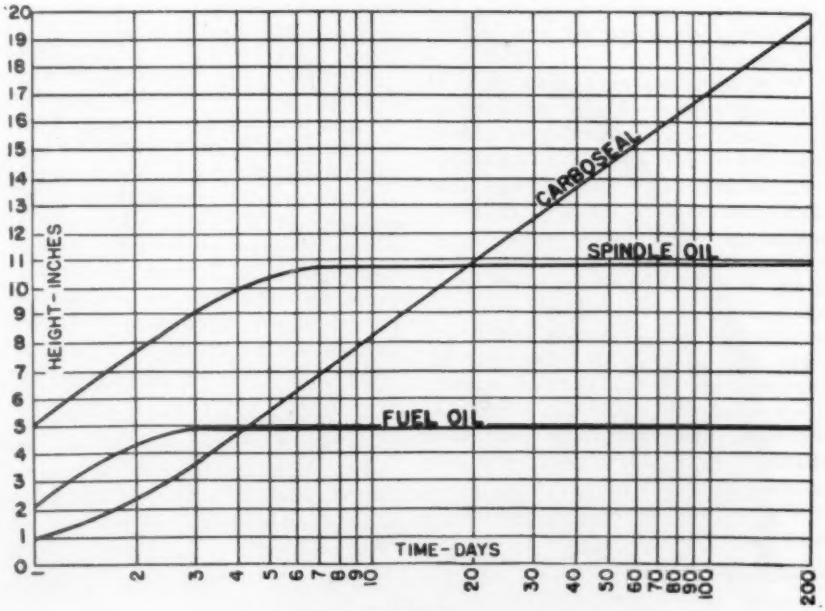

Exhibit 3

Curves of the character of those shown in Exhibit 3 were obtained from these tests. All of the oils tested had curves of the general character of those shown for spindle oil and fuel oil. The oils generally climbed fairly rapidly to some point between five and eleven inches and then stopped. The rate of climb and final height reached by the oil was also very greatly affected by normal changes in the density of the packing. Carboseal and related compounds had a somewhat slower initial rate of climb than the oils but finally climbed to the top of the test pieces. The rate of climb of Carboseal and related compounds was not greatly affected by normal changes in the density of packing. As a result of these tests and of the work done in the laboratory and in the field our conception of how these liquids function in sealing a joint may be summed up as follows:

After making a caulked joint with air dried jute it is evident that the fibers will tend to swell and be more tightly compressed by the absorption of water and condensate from the gas. In service, particularly during times past when a large amount of condensate existed in the main, it was natural that most of this condensate would remain at the interface between the metal and the jute. When conditions in the main changed so that the condensate tended to evaporate, there would be a contraction of the jute packing as a whole from the metal so that a space would be formed between the jute and the metal at the junction of the bell and/or at the junction of the spigot with the jute. If any of the condensate consisted of liquid phase gum formers, the exterior of the jute would probably be covered with a gummy varnish which would be either heavy or light depending upon the amount of gum formers present, and which would be hard or soft depending upon the age of the gum.

Any treating solution which is intended to cause a tightening of the joint through the swelling of the jute fibers must first penetrate the gummy residue on the surface of the packing and then must be strongly absorbed by the fibers and cause them to swell.

Another consideration is that the solution must cause individual jute fibers to retain their elasticity or rigidity rather than to cause them to become soft and flaccid. Unless the individual fibers regain their springy elastic character the packing will not redistribute itself uniformly throughout the space even if some swelling does occur and thus a few spaces will be left which are too large for effective liquid sealing.

A few cases have been observed of a jute impregnated with an extremely hard gum. No suitable non-volatile solvent has yet been developed which wholly is effective. Our very few discouraging results on low pressure mains are confined to situations where the jute has been impregnated with an exceptionally large amount of very hard gum, and in the few

instances where the jute packing has completely disintegrated and largely disappeared.

With these few exceptions the field tests made by the U.G.I. subsidiaries have paralleled the successful results reported by Mr. Hitz[1] at Poughkeepsie. In general, Carboseal has been used successfully on low pressure mains up to 12" in diameter.

Our experience on intermediate pressure mains has been more variable. We have treated one 4" intermediate pressure main in which we were able to stop all leaks, but on certain other 4", 6" and 12" mains, however, at intermediate pressures, we were not completely successful although decided benefits were obtained.

The following are typical field tests.

Field Test Results

Main Street Area — District A. During the spring of 1934 the old mains on Main Street, District A, from Walnut to Markley Streets were treated with Carboseal. These joints were examined before the street was repaved and showed that the leaks had stopped. The examination took place six weeks after the treatment. The following is a summary of the number of joints and the treatment used:

240 - - - 4" lead joints
125 - - - 8" lead joints
44 - - - 12" lead joints

A total of 49 gallons of Carboseal was used, of which 10 gallons were recovered in the drips making a net requirement of 39 gallons. It was impossible to make a further examination of these joints because the street was repaved. However, there have been no indications of joint leaks in this area since the treatment. All telephone and sewer manholes were tested about two years later and no leaks were found. Prior to the treatment there were complaints of gas odors in the telephone manholes and several sections of gas mains were renewed ahead of this paving project.

Marshall Street Area—District A. Carboseal was injected to cover a large area between Lafayette and Marshall and between Noble and Markley Streets. 122 gallons of Carboseal were used and 9 gallons were recovered. The total number of joints treated has not been determined as yet, and it is believed that more Carboseal will be recovered when the flow in this area is fully traced. The main record books do not show the flow in all cases and we may find two "lost" drips before we complete our investigation.

Marshall and George Streets—District A. While repairing a broken 4" cast iron main on George Street several joints were found to be leaking. One of these joints was exposed and ten joints were treated with 5 gallons of Carboseal. Two gallons of liquid were recovered. A manhole was built around the exposed joint and the joint was examined periodically. At the end of three days leaks on one joint were stopped and bar holes on other joints gave no odor of fresh gas.

At the end of six weeks the exposed joint has not yet shown any leaks. This joint will be examined periodically for three years to determine when and if the treatment becomes ineffective.

High Street—District B—Between Charlotte and York Streets. This main is part 2-inch and part 3-inch cast iron main with lead and cement joints and had been leaking for several years. During 1935 these mains were treated with Carboseal in December and the leaks at manholes and sewer vents disappeared.

This treatment was repeated in January, 1936. Two joints were exposed in April, 1936, and no leaks were found on joints; however, the main was found to be in very poor condition and very thin. This main will be replaced in 1936; at that time we will be able to see if any of the joints are leaking.

High Street—District B—Between Madison and Evans Streets. This main is the 6-inch cast iron main on the south side of the street and was leaking at all joints during February, 1936. All telephone manholes were full of gas and gas was entering the cellar of the Post Office through telephone ducts.

The two-inch cast iron main on the same side of the street was abandoned and most of the gas leaks stopped. However, odors of fresh gas continued in the manholes until one week after the main was treated with Carboseal. Manholes were examined in June, 1936, and no odors were present.

Powell Street—District A. On Powell Street from Brown to Basin Streets, some of the 4-inch cast iron joints were leaking. There were two trees dying between Freedley and Brown Streets. This main was treated with Carboseal in July, 1935, and twelve joints were exposed one week later. Six of these joints were recaulked and leak clamps were installed. The other joints were not leaking. There has been no evidence of further leaks on this main to date. The two trees seem to be in healthy condition now.

Elm Street—District A. On Elm Street between Astor and Stambridge Streets, 4-inch cast iron joints were leaking slightly. This main was treated in July, 1935, and there has been no evidence of any gas leaks to date.

The streets on which all of the mains were treated in District A have been repaved making it undesirable to expose the joints to determine the success of the treatment. However, this is the third year for some of these mains since we treated them and we believe that if any of the joints were leaking any appreciable amount of gas we would have had complaints during the past winter when the ice was on the ground.

Another large company treating a 12-inch main carrying intermediate pressure gas has reported as follows:

"Attached hereto is a sketch (Exhibit 4) showing the six test joints on the 12-inch pumping main on the Branford Hill. The sketches show the lead joint, the inner ring showing the line between the lead joint and the pipe, the outer ring showing the line between the lead joint and the inside of the bell.

"The circles show where the joints were leaking on October 10, 1935, before any Carboseal had been applied. The crosses show the leaks which were still visible on July 16, 1936, after the final treatments with Carboseal.

"The leaks which showed on the 16th of July were extremely small leaks, so small that it was very difficult to see them even with the soap bubbles.

"There can be no question that applying Carboseal has greatly reduced the leakage in this line."

In Bulletin No. 1 "Rejuvenating Gas Distribution Systems with Carboseal" a quantitative study of the gas losses in a distribution area containing about five miles of low pressure (3-inch equivalent) cast iron main was described.

It is now more than two years since this treatment was started and the results are as follows:

	Date	Leakage per mile of 3" equivalent MCF/year.
(a) Before treatment	Jan. 1934	560.1
(b) After liquid treatment	Jan. 1935	285.8
(c) Before service repairs	July 1935	231.4
(d) After service repairs	July 1935	200.5
(e) Approximately two years after treatment	Jan. 1936	235.7

The residual leakage is attributed to

(a) defective joints

(Continued on page 112)

[1] *American Gas Journal, April, 1936.*

You

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CLEVELAND BABY DIGGER—MODEL 95

City and Suburban trenching is beset by many obstacles—pipe must be laid in the pavements, the treelawns, the sidewalks, or back of the sidewalks. Pedestrian and vehicular traffic, curbs, poles, trees, shrubbery, fences, buildings, alarm-boxes, conduits and pipes of other utilities, cables, drains, catch-basins, fine lawns, sidewalks and driveways, are some of the many difficulties to be constantly reckoned with and overcome. "Baby Diggers" have conclusively demonstrated their superior ability to cope with such obstacles successfully, *and get the most out of machine-trenching*, wherever the job.

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The CLEVELAND BABY DIGGER

Controlling Components of Lost and Unaccounted-for Gas

By George Wehrle
Superintendent Gas Department
Public Service Co. of Colorado
Denver, Colorado

BETWEEN the station meter at the gas works, or the town border meter on a natural gas pipe line, and the customer's meter, there is a void entailing a source of potential loss of profit and a possible danger in unaccounted-for gas. This may be likened to an uncharted ocean where the passage is extremely costly and hazardous but which can be transformed into a normally safe and economical passageway when the various reefs and shoals are accurately located, the weather forecasts taken into account and the course of ships systematically and scientifically controlled.

While lost and unaccounted-for gas is the difference between the gas manufactured or purchased and the gas sold to customers, all of the factors comprising this difference are not entirely controllable. Therefore, it is not possible to completely balance the two measurements and completely eliminate this objectionable feature of gas operations. The principal influencing factors of lost and unaccounted-for gas usually are temperature, pressure, accuracy of meter registrations, billing lag, irregularities, and leakage.

The Temperature Factor

The temperature factor may vary in its importance on account of load tendency, climatic conditions and regulations or contract stipulations affecting the measurement of the gas delivered to a distribution system; and it is one of the influencing factors of unaccounted-for gas over which the least control may be exercised. It is possible to correct the gas measured into a distribution system to a standard temperature; but whether this is done or not, there is usually a difference between the delivery measurement and the customer measurement which is not correctable. This difference normally appears as unaccounted-for gas.

The measurement of large volumes of gas sold to industrial customers may be, and usually is, accurately determined by using temperature recorders on delivery and sales meters and correcting to a common temperature base. However, this is uneconomical in the case of the ordinary gas customer under normal rate schedules. No practical means has come to this writer's attention whereby temperature corrections may be made at the customer's meter.

Manufactured-gas companies customarily correct the gas measured at the station meter to a standard temperature, but most natural gas is metered into a distribution system at temperatures assumed to be standard. Where gas measured into a distribution system is corrected to a standard temperature, there will be a difference in volume at the customer's meter at all times that the temperature at this point is above or below the standard temperature. Quite naturally, the volume of unaccounted-for gas due to this cause will vary with the system load, and its characteristics, from hour to hour, day to day, and month to month, all of which makes the compilation of loss from this source an involved problem. In temperate climates and in distributing companies where heavy heating loads are experienced in winter, the volume of gas going into the unaccounted-for increment on account of differences in temperature at which the gas is measured or computed may be of considerable consequence. When the terms of a contract assume the temperature of natural gas at the point of delivery to be standard, the factor of temperature in the unaccounted-for gas will usually be of slight consequence since the temperature of the gas at both metering locations will approach that of the ground and will usually be nearly equal.

The Pressure Factor

As Charles' Law affects unaccounted-for gas volumes in the case of temperature, Boyle's Law is likewise effective in the case of pressure at the point of measurements. Ordinarily, gas is sold to the customer at the atmospheric pressure prevailing in his meter plus a sufficient gage pressure to insure efficient operation of his appliances. The pressure at which the gas is measured into the distribution system may be that of the local atmospheric pressure prevailing, it may be assumed to be at a certain standard pressure by contract terms (which is in effect the same as the first condition), or it may be corrected to an arbitrary or standard pressure base. In either case, a fixed gage pressure is superimposed. Conditions of pressure at which gas is measured at delivery and customers' meters are more uniform and can be controlled more readily than temperature. Therefore that portion of the unaccounted-for gas attributable to pressure differences at points of measurement may in most cases be quite accurately determined and catalogued.

Meter Accuracy

The accuracy of meter registrations, while a mentionable item, is one which is highly controllable. The customary standards of meter maintenance and meter accuracy in the gas industry make this factor of slight consequence in an analysis of unaccounted-for gas.

Billing Lag

Billing lag may cause exceedingly large monthly increments of unaccounted-for gas where the load is composed largely of space-heating use, where other uses cause similar loading, and where the delivery month and the billing month do not coincide. Where meters are read continuously throughout the calendar month, the average reading date becomes the middle of the month and the billing lag will then equal the volume of gas used by customers in excess of the average daily use from the middle of the billing month to the date upon which statements are made of the gas delivered to a distribution system. When the curve of the sea-

FORM 65-2 SM-6-36

PUBLIC SERVICE COMPANY OF COLORADO

GAS MAIN INSPECTION BLOCK NO._____

TEST	DATE	BY	DETECTOR
1			
2			
3			

_____ ST AVE.

C. I. STEEL ____ FT. ____ OF ____ P. L.

STREET SURFACE

LOCATION	DETECTOR READINGS MAIN 1	MAIN 2	MAIN 3	SPECIAL 1	SPECIAL 2	SPECIAL 3	REMARKS
FT. OF P. L. OF							
FT. OF P. L. OF							
FT. OF P. L. OF							
FT. OF P. L. OF							
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FT. OF P. L. OF							
FT. OF P. L. OF							

NOTE: Make tests at all Crosses, Drips and Manholes, and over Main in cases where service inspections are more than 50 ft. apart.

Fig. 1

sonal or annual load is ascending, the billing lag for any month will be a loss, and when it is descending, the lag is a gain. Therefore, where the annual load is uniform the losses and gains will be compensating. It is customary where load conditions cause severe billing lags in winter months to consider the annual volume of unaccounted-for gas to be for a twelve-month period ending August 31 of each year instead of for the calendar year. Load lag can be entirely avoided only when all customer meters are read on the same day that delivery statements are taken.

Irregularities

Irregularities are controllable to the extent that policing of customers' premises may be exercised and through precautionary measures employed. In recent years, an expansible rubber plug has been developed which is inserted into the house end of a gas service pipe and which is compressed or released by means of an ingenious key wrench. It is standard practice in many companies to insert these plugs in all service pipes when gas service is off for any cause and the use of this device has been a great help in controlling irregularities.

Leakage

The sixth, and the most important, factor or component of unaccounted-for gas is leakage. This factor is important not alone from the standpoint of value of the gas lost between the point of delivery into the distribution system and the customer's meter but on account of the hazard to life and property which is involved in escaping gas. Since the distributing pipes of a gas company are buried and out of sight, usually three to five feet underground, and often under heavy pavement, the control of this source of loss involves most careful planning, systematic methods of working and adequate records, keeping in mind at all times the factors of economy and safety and their balancing in a reasonable and practical program of leakage abatement.

Public Service Company of Colorado has operated under a policy of leakage abatement for many years and has developed a system which has culminated in methods of handling the work and keeping the necessary records in a most satisfactory manner. This has produced results that have been extremely gratifying to the owners and operators of the property. A description of the so-called "Denver Plan" is given with the thought that it may be of interest to gas operators elsewhere.

"Denver Plan"

The management of this Company has taken the position that the exercise of due diligence in the inspection of its gas distribution system is a prime requisite of prudent operation. It has found that such diligence pays dividends of worth-while proportions in safety and economy, both of which reflect in net earnings. The program which has been laid out comprises the inspection and test at regular intervals of all business and public buildings and all manholes, conduits and street vaults, as well as the testing at regular, but less frequent, intervals of all gas mains and services.

From two to three men are continually employed in Denver in the work of inspecting business and public buildings. Inspections of business buildings are made twice each year and public buildings are inspected every three months, with the exception of theaters which are inspected every month. The inspection work includes tests with a combustible gas detector along the front basement wall and at all pipe entrances and openings in all basement walls, examination of all exposed gas piping and all meters on the premises. Underground vaults, manholes and valve boxes are tested with a combustible gas detector at six-month intervals. Conduits entering telephone and telegraph exchanges are tested for leakage every month. Very frequently, extremely dangerous conditions are discovered by this precautionary work which, in our estimation, more than balances the cost thereof.

The work of testing for the presence of escaping gas and making repairs to underground gas pipes has become a routine operation, systematically and continuously carried

FORM 65-4-20M-9-34

METER IN USE____ TURNED OFF____ NO METER____

PUBLIC SERVICE COMPANY OF COLORADO

GAS SERVICE INSPECTION HOUSE NO._____

DATE SERVICE LAID_____ _____ ST. AVE.

SIZE____ SERVICE____ FT.____ OF____ P. L. OF_____ ST. AVE.

SERVICE ENTRANCE ON____ SIDE WALL____ FT. FROM FRONT WALL

SERVICE ENTRANCE ON FRONT WALL____ FT. FROM____ WALL

TAKEN FROM MAIN IN _____ ST. AVE.

NOTE: UNDER REMARKS OR ON BACK OF CARD ANY CONDITION WHICH REQUIRES SPECIAL ATTENTION.

DOES SERVICE RUN THROUGH UNEXCAVATED PART OF BASEMENT?____

DATE INSPECTED	INSPECTED BY	READINGS: SERVICE ENTRANCE	FT. FROM ENTRANCE				CURB	MAIN	TYPE OF DETECTOR	REMARKS

Fig. 2

NOTE: SHOW READINGS AT ENTRANCE, AT CURB AND AT ONE INTERMEDIATE POINT. SHOW ADDITIONAL READINGS ON LONG SERVICES OR WHERE LEAKAGE IS FOUND.

on. In 1932, the work of making an exact leakage survey in Denver was begun and it was completed late in the year 1935. This work consisted of barring to the pipe and testing with a combustible gas detector at 50-foot intervals over all mains and at 15-foot intervals over all services and the repair of such leaks as were found to be of sufficient magnitude to justify the cost of repairs or, regardless of economic justification, presented any hazard which might result in an accident or damage to property. At the present time, a card record is available showing in exact detail the work done, conditions found, and the result accomplished in this survey. A second survey is now under way and it is believed that coverage of the entire distribution system in five years, with more frequent testing of the so-called "hot spots," will meet our requirement for prudent operation.

The forms used for keeping the record of leakage inspections consist of three 4 x 6 cards. The first (Fig. 1) is a salmon-colored card, one of which is used for each block of main in the exact survey. The second (Fig. 2) is a white card, companion to Fig. 1, one of which is used for each address or service in a block.

FORM 88-3 GAS DISTRIBUTION SM--12-33

PUBLIC SERVICE COMPANY OF COLORADO

_____DETECTOR GAS MAIN AND SERVICE INSPECTION BLOCK NO._____

STREET SURFACING_____ _____ ST. AVE.

C. I. STEEL MAIN____FT.____OF____PL. DATE INSPECTED_____BY_____

NUMBER	LOCATION	Size	Year Laid	READINGS Main	Crown	Curb		P. L.	Lawn	Wall	REMARKS
	FT. OF P L. OF										
	FT. OF P.L. OF										
	FT. OF P.L. OF										
	FT. OF P L. OF										
	FT. OF P.L. OF										
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	FT. OF P.L. OF										

Fig. 3

When the exact survey of a block is completed, the white service cards are filed in numerical order behind their respective salmon-colored main cards. Fig. 3 illustrates a form which may be used for random surveys and for location work. This card is designed to meet the need where tests of a general nature are made. Repair work is executed on regular work-order forms with suitable notation upon the filed survey card to tie the two together for reference.

No attempt is made in this article to describe in detail the methods employed in actually doing the work involved in leak testing since this is more or less a routine activity in present-day gas operations and to do so would present nothing of novel feature. The combustible gas detector, while a recent innovation, has become well known throughout the gas industry and is used by practically all operators. If there is any novelty in the so-called "Denver Plan" of leakage abatement, we feel that it is only in the systematic plan that has been devised, which involves continuous testing and repairs along accurately planned and controlled lines. This, we feel, when combined with the consideration of other controllable factors briefly discussed herein, removes a lot of the uncertainty from lost and unaccounted-for gas and makes of it a charted course which may be followed with impunity.

Measurements of Flame Velocity Aid Designers of Gas Burners

National Bureau of Standards to Publish Results of Recent Work

Better design of gas burners with resultant economy in the use of fuel gases supplied to the public may result from recent measurements made at the National Bureau of Standards, Department of Commerce, on the velocity with which flame spreads throughout the combustible mixture issuing from burners of different types, it was announced.

This velocity of flame propagation is one of the important factors which must be taken into account in any study of the performance and design of gas burners, it was stated.

Notwithstanding the years of study which have been devoted to flames and the mechanism of combustion, many workers using different methods still obtain different results which cannot be readily correlated or even compared on a common basis. This comes largely from the profusion of variables, some of them controllable, some not, and some probably unknown, according to the Standards Bureau.

In its work, the bureau utilized the burner method of measuring flame velocities, and was able to separate, one from the other, the effects of changing the size of the burner port, of changing the rate of flow and composition of the combustible mixture, and of using measurements of different quantities and of different parts of the flame surface in computing the result.

Coming Events

October

15 New England Gas Association, Accounting Division, Narragansett Hotel, Providence, R. I.

19-23 National Metal Show and 18th Annual Convention, American Society for Metals, Public Auditorium, Cleveland, O.

Week of October 25 American Gas Association, 18th annual convention, Atlantic City, N. J. Alexander Forward, managing director, 420 Lexington Ave., New York.

October 25-30, Inclusive, Exhibition of Gas Appliances and Equipment at the First Annual Convention Association of Gas Appliance and Equipment Manufacturers in Affiliation with the Eighteenth Annual Convention of the American Gas Association, Atlantic City Auditorium, Atlantic City, N. J.

Leaders in every INDUSTRY *Now Using*

CHACE THERMOSTATIC BIMETAL

For more than a decade the W. M. Chace Company has steadfastly built a reputation of leadership in the manufacture of Thermostatic Bimetal. Today leaders in every industry look to Chace for their Bimetal requirements.

Chace Thermostatic Bimetal is now used on products in all industries—wherever automatic control of temperature is called for, or wherever automatic action must take place with changes in temperature. Oil burners and stokers, gas-burning appliances and automobiles, hot water heaters and electric appliances, refrigerators and air-conditioning units, room and oven thermostats—all use Chace Thermostatic Bimetal for unfailing, automatic control.

Make sure the thermostatic control in your product is Chace Thermostatic Bimetal. You will make no mistake in following other leaders in American industry by using Chace Thermostatic Bimetal to solve your control problems.

If your product is designed to control temperature, or if it must create a certain action at pre-determined changes in temperature, Chace Thermostatic Bimetal will do the job for you efficiently—*and automatically!*

Our recently enlarged manufacturing plant, expanded laboratory facilities, and new, specialized equipment place us in an even better position to make quick delivery of your Bimetal requirements.

Chace engineers are ready to study your Bimetal problems and recommend the type of Bimetal best suited to your product. There is no obligation.

W. M. CHACE COMPANY
1610 BEARD AVE. DETROIT, MICH.

PITTSBURG'S *Streamline-Complete Line* IS READY FOR A BIG 1937

● And Pittsburg's "Simplified Selling Plan" is an extraordinarily different kind of merchandising which has proved in actual test that it can double and even triple a salesman's business.

Maybe every week-end, guests surge through the big house, with washing, shaving, bathing and a multitude of other demands to keep hot water faucets working overtime . . .

Or maybe it's a quiet little family of three who need their "Gallons of Hot Water A Day", but not so many . . .

Either way, or for any situation in between, Pittsburg meets every conceivable consumer requirement with "custom-tailored" exactness.

This is because of an entirely new idea, reflected in a line of products that are superbly modern in functional design and are equally advanced in engineering.

Pittsburg's heaters with new high efficiency, certified low cost operation and guaranteed long life, are a line definitely in tune with market trends and consumer demand. They are designed in 3 price brackets to meet local conditions.

To every alert sales manager, there is interest value in Pittsburg's up-to-the-minute viewpoint and in Pittsburg's newly conditioned and conveyorized plant which is all ready for a "streamline" production flow.

Vastly more interesting are the features that make Pittsburg's a-year-ahead-of-the-times products so remarkably salable.

Most interesting of all Pittsburg's advancements is the exclusive, patented and copyrighted streamline merchandising plan of "Simplified Selling", which makes individual sales easier and multiplies volume.

Look at the next page and plan to go to the convention where you will see the line and plan demonstrated in detail.

THE PITTSBURG WATER
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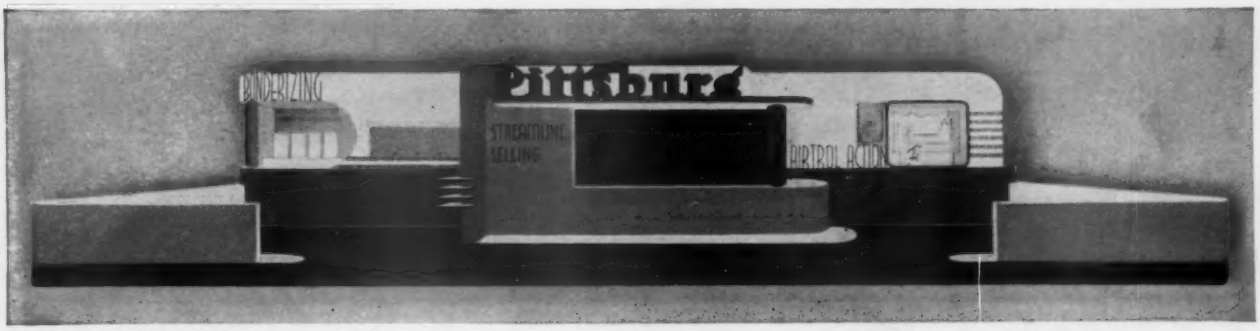
PREMIERE SHOWING OF THE "LIVEST LINE" IN THE INDUSTRY



Booths 312 and 313 Atlantic City where you will see daily demonstrations of the "hit of the show" in water heaters and the plan that sells them.

● SOMETHING NEW..."STREAMLINE" SELLING...THE SIMPLE, EASY WAY

Pittsburg's "Simplified Selling Plan" is made up of a series of logical steps which take the shortest route to the main objective, SALES.

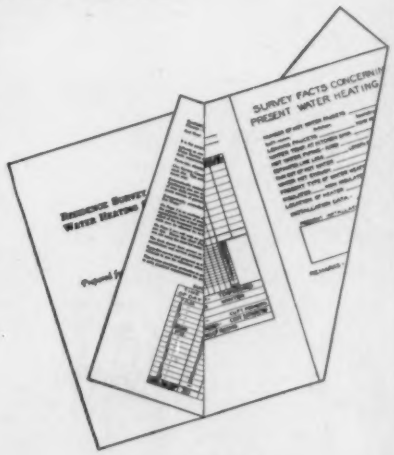
It's simple, scientific, fundamental and dramatic and it is operated with a sales kit which has no fluff, guff or gush but consists of bare essentials.

PITTSBURG'S SIMPLIFIED SALES MANUAL

Ten minutes of exciting reading for any man who ever sold or who sells.

PITTSBURG'S DOOR OPENER

A door opener that opens the door, gets the man in and all over the house while the consumer goes along to "help" him.



PITTSBURG'S SLIDOGRAPH
(Patented)

Helps the salesman dramatize his show and scientifically aids him in actual determination of gas consumption, heater size and operating costs.

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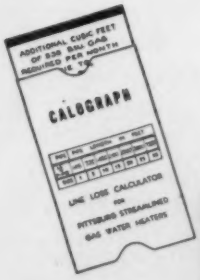
A "show" piece of scientific value in determining line loss due to location of heater.



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WATER HEATERS

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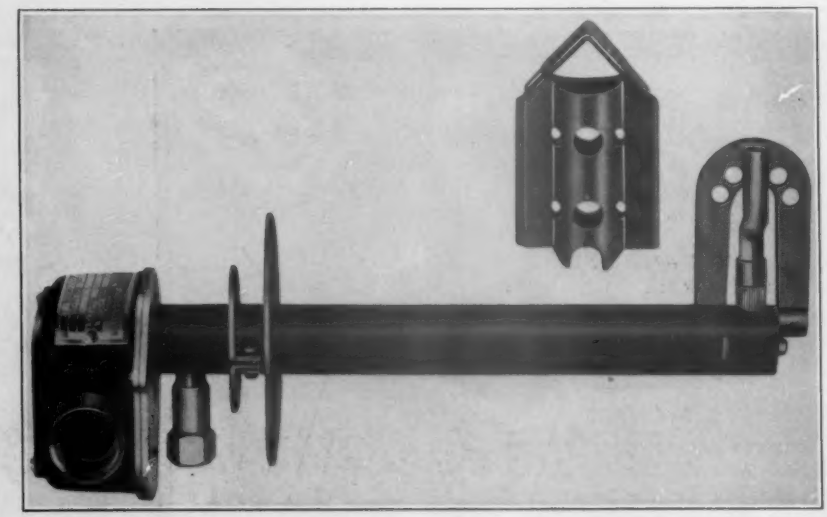
ARE DEPENDABLE

Mercoid Controls are noted for their quality and reliable service. They are built to a standard of perfection, which is constantly maintained. All Mercoid Controls are equipped with sealed mercury contact switches which cannot be affected by dust, dirt or corrosion.



MERCOID POWERSTAT

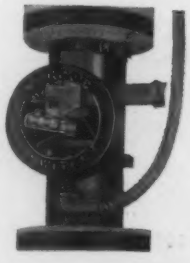
The Mercoid Powerstat offers positive automatic pilot protection for gas burning ovens, furnaces, boilers, space heaters, floor heaters, hair dryers or any type of gas burning appliance. • The speed of action and uniformity of operation insure absolute protection at all times. From THREE to FIVE seconds only are required to open or close the electric circuit. The actuating unit of a new and revolutionary principle eliminates the weaknesses heretofore present in gas pilot controls. The operation is not affected by surrounding combustion chamber temperatures, as the actuating unit is not a bi-metallic element.

SENSATHERM

This instrument combines beauty with mechanical perfection. Operates on temperature variation of ½° above or below point set. (Total differential 1°). Types available for day and night temperature regulation and heating and cooling applications.

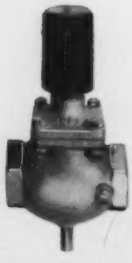
PRESSURE CONTROL

Positive safety limiting device, widely used on steam boilers. Actuated by specially designed Bourdon tube of great strength and elasticity. Has external independent adjustments with high and low setting each indicated on visible calibrated dial.



RISERTHERM

Designed for temperature control by surface contact on risers of hot water systems or hot water tanks. Mounting is interchangeable so that it can be easily attached either in a vertical or horizontal position. Write for information.



MAGNETIC GAS VALVES

A complete line of magnetic valves is available for controlling gas, oil, water or air. They are exceptionally quiet in operation and dependable in performance. They are particularly recommended for gas burner applications.

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THEY ARE DUSTPROOF AND NON-CORROSIVE. THERE CAN BE NO PITTING, OXIDATION, OPEN ARCING OR DETERIORATION

RCOID CONTROLS ARE EXCLUSIVELY EQUIPPED WITH SEALED MERCURY CONTACT SWITCHES

Staten Island Has Model All-Gas Home

Chamber of Commerce and New York and Richmond Gas Company Stage Effective Publicity Program

C. A. Kennedy

New York and Richmond Gas Company,

Stapleton, S. I.

THE Chamber of Commerce Modern Gas Home, completely equipped with gas heating and cooking appliances, will be awarded as a door prize at the Staten Island Exposition of Progress on October 26th. It was opened to the public on September 16th.

Since that date, a steady stream of people have inspected it and its complete gas equipment. On Saturdays and Sundays as many as 1500 visitors have been counted. As a result, many excellent prospects for gas appliances have been obtained and a number of sales can be directly traced to their visit.

This home can be won by any Staten Islander who attends the Exposition of Progress. Wide publicity is being given it by the Chamber of Commerce, by the building supply dealers and merchants who have had a part in its construction and furnishing, by the newspaper and by the gas company. As a result, it has become one of the main topics of conversation on the Island. Because of this widespread and constantly increasing interest, it is expected that some one from every Staten Island family will have visited it before the final award in October.

The complete gas equipment consists of a Bryant Winter Air-Conditioning and heating unit, Penfield 30-gallon Copper High Low Storage Water Heater, Manchester Universal Gas Range with lamp, measured time and condiment set, P.G. 500 Electrolux Gas Refrigerator, #6 Home Gas Incinerator, #85 Humphrey Radiant Fire Heater, #01 Homestead Woodfire Heater. Qualified attendants are available throughout the day and into the evening to explain this equipment. The modern all-gas home is flood-lighted each night by Humphrey Super Candle-Power Gas Lamps.

This is the first opportunity Staten Island gas consumers have had to see many of these gas appliances installed in actual home settings. The result is they leave with greatly increased appreciation of the beauty and practicability of gas appliances. The photographs show why they are so favorably impressed.

To get the last full measure of sales value out of this modern all-gas home, the New York and Richmond Gas Company is running a special Modern Home Sale offering liberal trade-in allowances on gas ranges and suggesting in the advertising that a visit to this all-gas home will give its customers new ideas while this special sale makes possible a home modernization program on very liberal terms. The tie-up works effectively both ways. It helps to get more visitors to see this home. It helps make sales from those who have seen it.

The Gas Company Exhibit at the Exposition of Progress will capitalize the great interest created throughout Staten Island by this last word in 20th Century home convenience and comfort.

The all-gas kitchen with efficient gas range and the marvel of refrigeration satisfaction—the Electrolux gas refrigerator.

A corner of the basement recreation room showing how gas brings new and thrilling opportunities for cellar rehabilitation.

THEY ARE DUSTPROOF AND NON-CORROSIVE. THERE CAN BE NO PITTING, OXIDATION, OPEN ARCING OR DETERIORATION

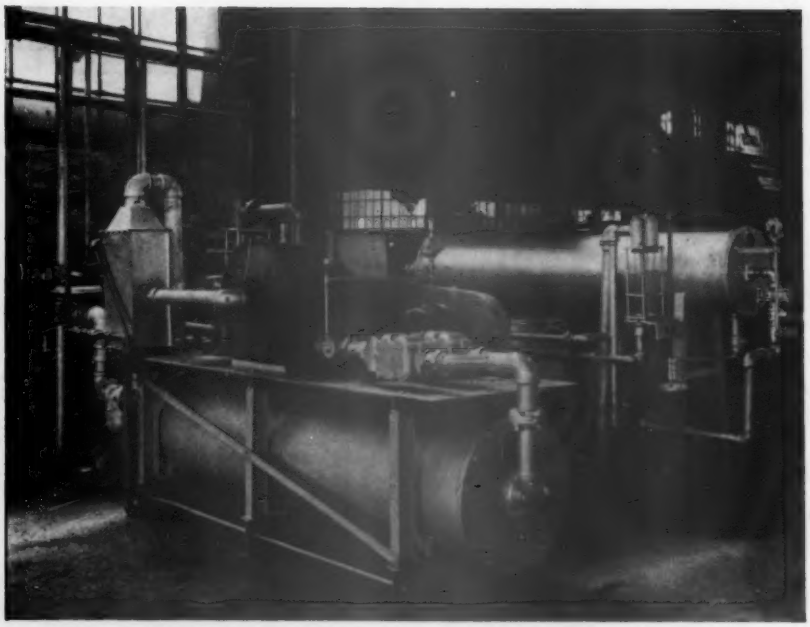


Fig. D—Atmosphere Gas Units for Use with Annealing Covers. Capacity 10,000 C.F.A. of Atmosphere Gas.

By

T. R. Matthews

The Eastern Rolling Mill Company, Baltimore, Maryland

and

L. E. Biemiller

Consolidated Gas Electric Light and Power Company of Baltimore, Baltimore, Maryland

Gas Fired Covers *for* Annealing Sheet Steel

More rigid specifications from the consumers of sheet steel, particularly those of the automobile industry, raised a problem difficult to solve. They demanded a more ductile, deeper drawing sheet, which would require fewer drawing operations. They required that sheets be flat, that they have a bright surface, and that all be equally annealed at the same temperature, whether they come from the top of the stack or the bottom. To meet these demands it was necessary that furnace manufacturers develop a new type of annealing furnace, which would operate at a reasonable fuel cost. The manufacturers' answer was the development of the annealing cover, a rectangular shaped bell type furnace which fits down over a stack of sheets, and heats them by radiation from alloy tubes in which is burnt gas fuel. This article describes such equipment for the annealing of automobile, as well as galvanized sheets in the plant of The Eastern Rolling Mill Company at Baltimore, Maryland.

The Old Method of Heating in Coal Furnaces

The old method consisted of piling steel sheets on a heavy cast steel base, then covering the pile of sheets with a heavy cast steel cover which rested in a thick sand seal. The covered base was then pushed on "cannon balls" into an open coal fired furnace, after which the doors were closed and sealed with fireclay. Then heat was applied by firing coal from three grates in each side wall. The coal had to be burnt with an insufficiency of air to keep the desired reducing atmosphere around the pot.

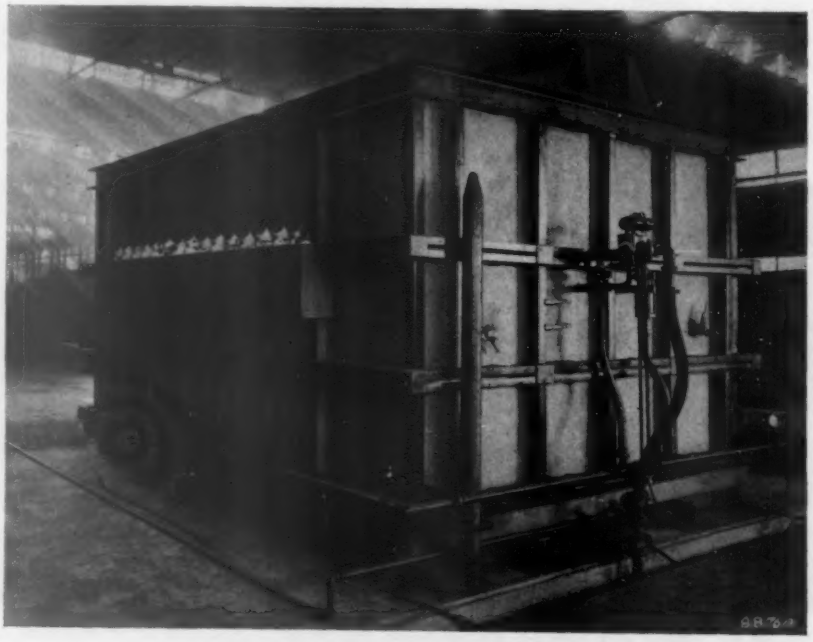


Fig. A. Annealing Cover for 62 x 170 Sheets.

It was impossible to get even heat distribution, and the top sheets were over heated while the bottom sheets were under annealed. The ends of the sheets were burnt and showed a deep annealing border.

If the pot contained 30 tons, the time taken to bring it up to the annealing temperature of about 1200°F was approximately 60 hours, after which it was soaked for 12 hours. Then the door was opened and the hot pot rolled out into the room where it was allowed to cool for about 120 hours. Meanwhile a slight pressure was maintained inside the cover by connecting to it a source of deoxidized producer gas, to prevent air being drawn into the inside of the cover as it cooled.

The following represents the important items of cost for annealing a typical 30 ton batch of auto body sheets by such a method:

Item	Cost Per Batch	Cost Per ton sheets
Furnace — 10% Fixed Costs per year on original investment	Omitted because investment is already made in this obsolete equipment	
Maintenance	$ 4.50	$ .15
Labor	15.00	.50
Coal—at $5.00 per ton delivered	19.50	.65
Power—KW at 1c	3.00	.10
Pot replacement	9.00	.30
Atmosphere gas	2.10	.07
Total above	$53.10	$1.77
Costs for dirt from ash and coal handling, excess space for furnaces, pot handling and coal storage	Undetermined—but considerable	

Radiant Tube Covers

The new method consists of the use of rectangular bell type covers which fit down over stacks of sheets placed on flat bases sitting on the floor. The bases are made of steel, cast iron, insulation and refractory shapes, and there are three or four bases for each cover. The use of three or four bases permits the cover to be in continuous use, while the several bases are being filled or emptied, or are holding sheets during the cooling process. A study of figure B will show bases arranged in series of three or of four, with one cover to each series. The bases contain sand seals so that the covers are connected to the bases by gas tight joints. This picture shows bases either under heat, in the process of cooling, or loaded waiting to be heated. In the case of the three series of bases in the foreground the heating covers are in the center of the series, and the stacks of sheets on the bases on either side are covered by inner covers.

Inner covers may be of alloy steel or of mild steel, but are usually of the latter when annealing auto or galvanizing stock. They are about ⅛ inch thick. The use of the inner cover permits the removal of the heating cover as soon as the soaking period is over, so that the cover can be immediately put to work again, without even losing its contained sensible heat. This of course also means that the outer cover, which represents a very large percentage of the total cost of this annealing equipment, is utilized at a good load factor, so as to reduce to a minimum the investment per ton of sheets annealed. The life of these inner covers is proving to be very satisfactory. Oriignally it was thought that an inner cover would last for about thiry heats, but in the plant under discussion here, a life of sixty heats is being obtained, by careful handling of the covers, and by the occasional application of a wash of black oxide, whiting and water glass. Besides reducing scaling, this coating makes the cover to all intents and purposes a "black body" which of course absorbs heat most readily.

The outer or annealing cover is clearly shown in figure A. The cover is of massive steel construction, and is lined with insulating refractories. It is heated by vertical radiant tube burners penetrating each of the side walls. The tubes are of heat resisting alloy, usually 28 Cr. 12 Ni. steel. A high pressure burner using 500 Btu. gas, at 10 pound pressure fires into a cast elbow which penetrates the cover wall, and looks upward. Here is attached a cast riser about 3½ feet in height, at the end of which is another cast elbow penetrating the cover wall to the outside again. The bottom elbow is fixed, and the top elbow is sealed in a box filled with chrome ore, to allow for expansion. The tube is about 4 inch outside diameter, and is one quarter inch thick. The covers under consideration here, are of a size tc handle sheets 72 by 160 inches piled 50 inches high. They are heated by 15 burners on each side, which are on 9 inch centers and fire into the vertical radiant tubes. Each burner has a capacity of 75000 Btu. per hour, burning gas at ten pounds pressure, and injects the required air for combustion. In the upper part of the vertical sections of the tubes are placed "core busters", cross shaped refractory baffles. They increase the velocity of the flue gases and give a scrubbing action against the tube walls which facilitates heat transfer. They also aid in radiating heat to the tube walls and in concentrating heat near the bottom of the tubes. The firing of the burner into an elbow at the bottom of the tube tends to develop a hot spot, but this apparent evil results in a desired gain, that of delivering a maximum of heat where it is needed, at the bottom of

Group of Annealing Covers with Bases Loaded and Covered by Outer or Inner Covers. Total Connected Load—27,000 c.f.h. of City Gas.

the stack sheets. Originally there was concern regarding the cost of tube replacement, but this has proven to be unjustified. Tube manufacturers will now guarantee a one year life at 1800°F. One of the covers here discussed has been in continuous operation over a year, and the tubes give no indication of failing. If a tube does fail it need not be replaced, as it can be readily patched.

It will be seen from the photograph of the single cover, that the gas supply is carried in a trench and is connected by rubber hose to the cover. In relocating the cover it is only necessary to turn off the valve located at the individual base, then break the union on the lower end of the base. and to break the electric circuit to the temperature control valve. The time temperature curve for a typical anneal is given in figure C. When the top temperature reaches the control point, the automatic temperature control valve reduces the gas pressure from 10 pounds to about 3 pounds. This curve indicates that the bottom of the stack is 50° cooler than the top. Actually there is no such great difference as is shown by the photomicrographs discussed later. It is possible to bring these curves together, but actual practice has shown that when this is done, there is a tendency for sheets on the bottom to stick together. With the thermocouples located as stated on the curve, and heating controlled so as to result in curves as here given, the resulting sheets indicate that the actual difference in temperature anywhere in the stack does not exceed 10° from that at any other point in the stack. With a given type of loading it must be determined what type of time temperature curve gives the desired anneal for given locations of two couples, and then the operator must duplicate such curves.

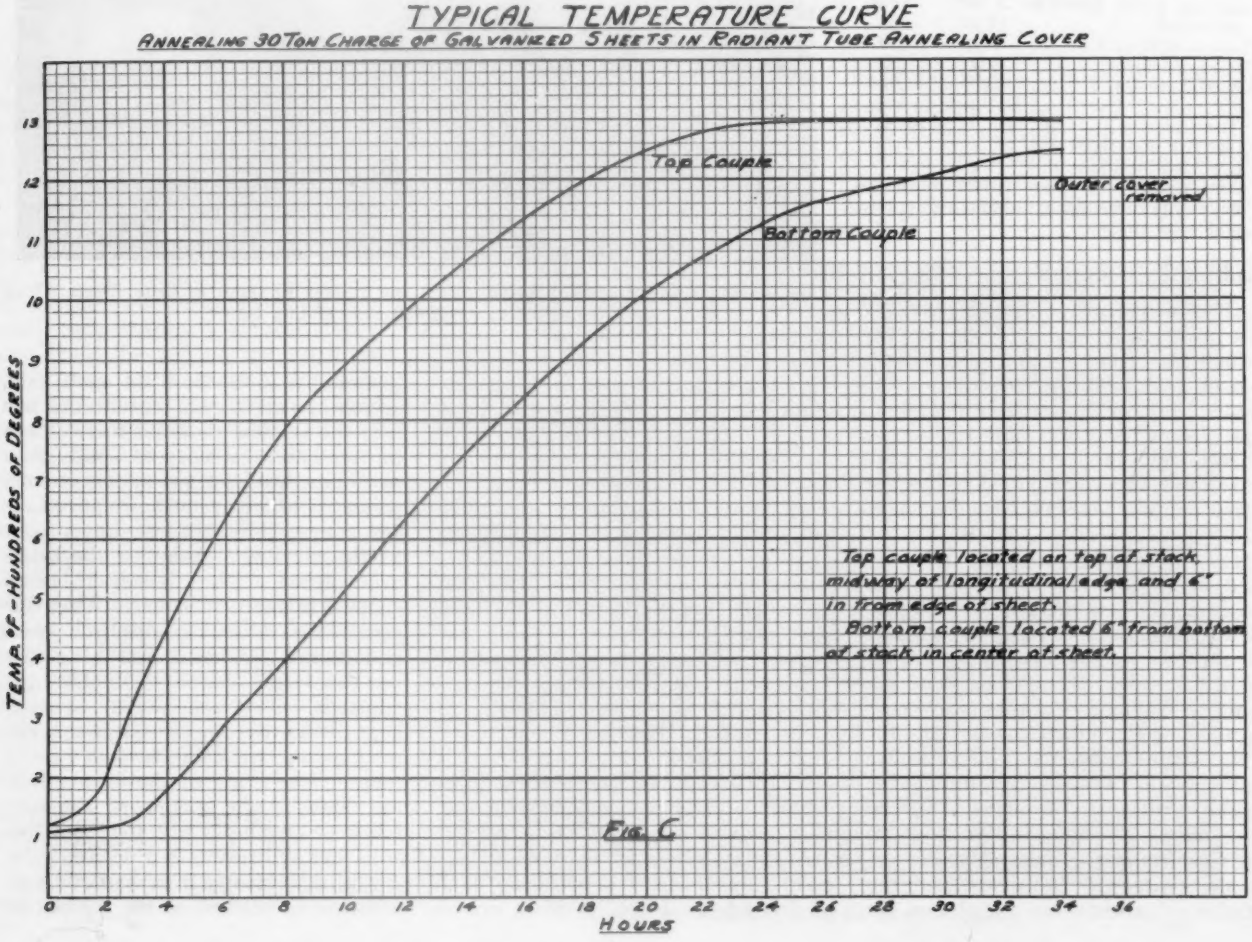
When heating a long pack all burners are operated until the top temperature reaches the control point, when alternate burners are turned off. For two hours burners 1, 3, 5, etc. are operated, and then for two hours burners 2, 4, 6, etc. are operated. This results in very fine heat distribution without any over heating. If two short packs charged longitudinally are being heated, at this point burners 1, 3, 4, 6, 10, 12, 13, and 15 are operated for two hours, and then burners 2, 5, 7, 9, 11, and 14 are operated for two hours. If exceptionally short packs are being heated so that a single base has three packs in a row longitudinally, after the top reaches the control point burners 1, 3, 7, 9, 13, and 15 are operated for two hours and then burners 2, 4, 5, 6, 8, 10, 11, 12, and 14 are operated for two hours. The intelligent operator can soon determine the combination of burners which gives him perfect heat distribution for a given type of load. Of course if the whole base is not loaded, some burners are not used at any time during the heating cycle.

The fuel usage will vary with the size of the load. The following gives the figures obtained with different size loads in covers here discussed, which accommodate a maximum load of about 60 tons:

GAS FUEL PER TON OF SHEETS ANNEALED TO 1250° F.

Load—tons	Gas Used Million B.t.u. per ton
60	.86
54	.92
40	1.00
30	1.25

The following represents the important items of cost for annealing


TYPICAL TEMPERATURE CURVE
ANNEALING 30 TON CHARGE OF GALVANIZED SHEETS IN RADIANT TUBE ANNEALING COVER
TEMP °F.—HUNDREDS OF DEGREES
HOURS
Top Couple
Bottom Couple
Outer cover removed
Top couple located on top of stack, midway of longitudinal edge and 6" in from edge of sheet.
Bottom couple located 6" from bottom of stack, in center of sheet.
FIG. C

a typical 30 ton batch of auto body sheets in a vertical tube cover, of a size to accommodate sheets 72 by 160:

Item	Cost Per Batch	Cost Per ton sheets
Furnace—10% per year on original investment	$ 6.90	$ .23
Maintenance	2.40	.08
Inner covers	6.00	.20
Gas at 60c per million B.t.u.	22.50	.75
Labor	9.00	.30
Power at 1c per K.w.h.	.60	.02
Atmosphere gas	2.70	.09
Total above	$50.10	$1.67
Increased value of sheets produced	In a large percentage of the cases, customers will no longer accept sheets from the old type annealing furnaces except as "seconds"	

By comparing this tabulation with that for the old type equipment, it will be seen that the overall cost is 10 cents less per ton with radiant tube covers when no fixed charges are included for the old equipment, and when there is no estimate of the increased value of the sheet obtained from the new equipment. The value of saving in mill space is not evaluated here. The cost for gas fuel with the new covers is only 15% more than the cost for coal fuel for the old equipment.

Comparison of Product Shows Higher Quality from Gas Heated Covers

A study of the accompanying photomicrographs shows clearly the improved quality anneal obtained when sheets are heated in radiant tube covers. Figures 1 to 9 represent the microstructures from a solid charge of 24 gauge material annealed in a radiant tube heated cover. The three test sheets were made from adjacent bars in the same ingot so that such phenomena as segregation of carbon and gaseous constituents would be applicable in each case. One sheet was placed at the top of the charge, one in the middle and one on the bottom.

Examination of the microstructure shows that all thru the charge the heat distribution has been even. There is a slight difference from one end piece to the other due to the fact that one end represents the center of the sheet bar (also of the ingot) as in rolling this gauge material the bar is rolled out to a certain length and then "doubled", thus making the original center of the bar an end of the sheet after the next rolling.

From the photographs it will be seen that each sheet has been thoroughly annealed, there being no essential difference between the grain structure of the ends and the center, although there is a slight difference in grain size between the two ends due to the "doubling" previously discussed, which makes the grain of the doubled portion smaller than the pure original skin of the ingot. But it can be seen that the distorted grains, as in figure 16 in the "hot rolled only" state, have been rounded out to the same extent, and that there are no directional layers of carbides or grain boundaries. Under each photo is given the Erichsen test, and it will be seen that in each case it was greater than the mill standard of 810 mm for this type of sheet.

Figures 10 to 15 show the result of annealing in the old coal fired furnaces. Figures 10 to 12 show good annealing, but figures 13 to 15 show quite a difference. The center of the bottom sheet, figure 14, has not received the same anneal, and the Erichsen test is well below the standard. With the old type of heating, from three fireboxes on each side of the furnace the edges of the sheets are heated to a higher temperature than the center, which is shown not merely by color but also by the Erichsen test.

On the other hand when heating in gas fired radiant tube covers, the ability to put exactly the quantity of heat desired at the point where desired results in the anneal as shown by figures 1 to 9. The ability to heat more evenly is due to some extent to the fact that heat from the radiant tubes penetrates an inner cover only ⅛-inch thick, whereas heat from the coal fire boxes must penetrate covers about two inches thick. The temperature from the coal varies, and the effect of any excessive temperature on the sheets is prolonged due to slow action of the heat in penetrating the thick cover; which often results in overheating the edges while the center is underheated.

In many charges from the old type coal fired furnace, the outer edges of the sheets are very wavy for a depth of about 12 inches, while centers are flat. This is due to unequal expansion of various parts of the charge. When heated too fast the center of the stack does not heat up and therefore does not expand, as fast as the outsides of the stack. The greater expansion of the edges of the sheets is relieved by these edges taking a wavy form. This deformation is so great that roller leveling will not have any effect upon it. A flat sheet is very essential if the sheet is to be galvanized, as now the user of galvanized sheets refuses to accept a sheet which is not perfectly flat.

Because the stack of sheets and the inner cover are both in a stationary position in the radiant tube cover, it is possible to keep the inside of the cover gas tight. While an atmosphere gas is usable with the old type pot, the pot cannot be kept tight in the moving, in and out of the coal furnace, and there is some infiltration of air inside the pot. This means that it is very easy, by use of the proper atmosphere gas, to obtain the same color throughout the sheet annealed in the radiant tube cover, but difficult if not impossible to obtain the same color if the sheet is annealed in boxes heated in the old type coal fired furnaces.

Special Atmospheric Gas from City Gas

The customer buying steel sheets today, not only demands that they be evenly annealed but also that they have a bright surface finish. This can be obtained by maintaining the sheets in a special gaseous atmosphere throughout the annealing cycle. This atmosphere gas is produced by the combustion of city gas with a deficiency of air, in a chamber filled with heated refractory to catalyze the combustion reactions so that absolutely no oxygen will remain. Then the water of combustion is condensed out, and the atmosphere gas cooled to approximately room temperature, when it can be readily distributed. In the plant here discussed there are two atmosphere units, see figure D, one of which uses an air-gas mixture produced by a Selas mixer, and the other an air-gas mixture produced by a Kemp carburetor. In both cases the air-gas mixture is supplied to the burner at a pressure of about one pound, and the products of combustion are maintained at a pressure of about one-half pound, and distributed at this pressure.

A small change in the air-gas ratio makes a large change in the chemical constituency of the gas produced. The following are the results obtained when using 500 B.t. u. city gas:

Air-gas ratio	Atmosphere Gas—% by Volume CO_2	CO	H_2	N_2
2.9 to 1	6.0	8.8	1.7	85.5
2.8 to 1	5.8	9.5	13.9	70.8

Atmosphere units of this type cannot be operated below approximately 25 per cent of their capacity without danger of the temperature of the combustion chamber falling too low with the possibility of not burning

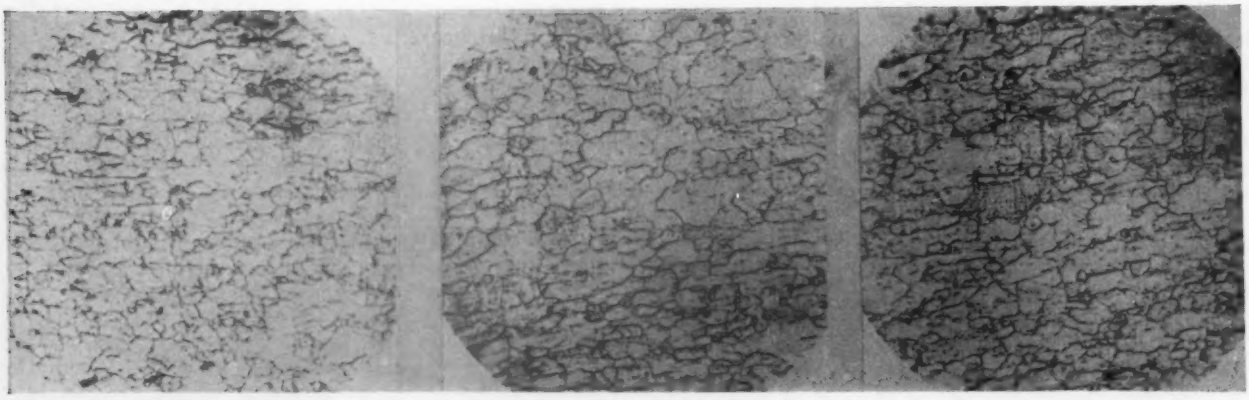


FIG. 1 END 830 M M FIG. 2 CENTER 870 M M FIG. 3 END 860 M M

TOP OF CHARGE

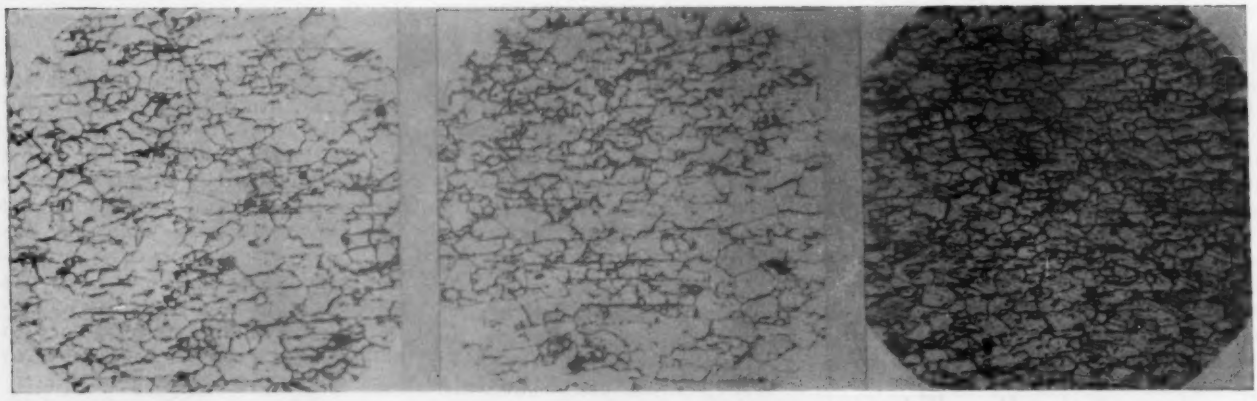


FIG. 4 END 850 M M FIG. 5 CENTER 860 M M FIG. 6 END 880 M M

MIDDLE OF CHARGE

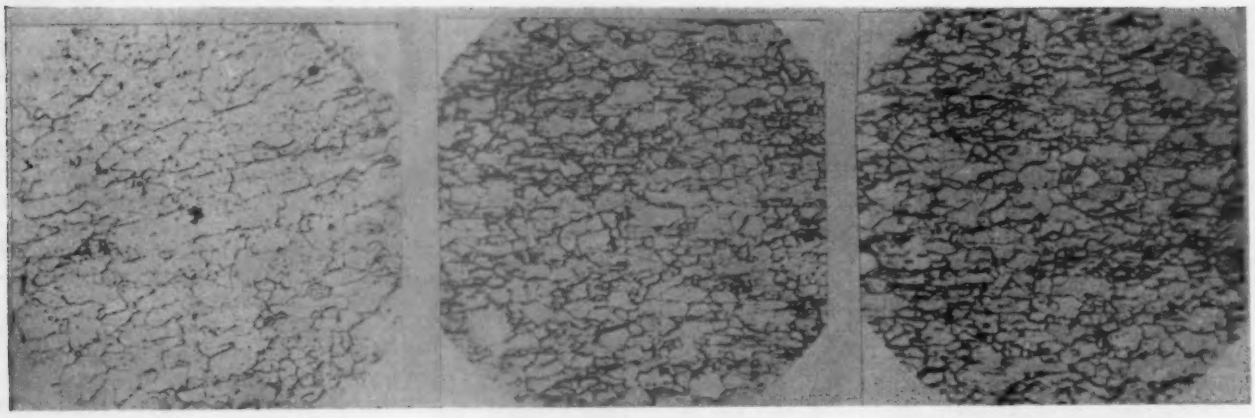


FIG. 7 END 850 M M FIG. 8 CENTER 890 M M FIG. 9 END 920 M M

BOTTOM OF CHARGE

Specimens—Rolled and Annealed in Radiant Tube Cover. Mag. X175, Erichsen Standard 810 M M

all the oxygen or completely dissociating the hydrocarbons. When operating the atmosphere unit at a capacity of 50 per cent or more, the quantity of 500 B. t. u. gas used is approximately 300 cubic feet per ton of sheets annealed in vertical radiant tube covers.

One of the greatest advantages in the use of this type atmosphere is in the great ease of pickling of the finished sheets. Sheets annealed in this atmosphere are pickled with the use of 10 per cent less acid, and in 10 per cent less time.

Other Uses of Gas Fired Radiant Tubes

While the outstanding use of radiant tubes in the past year has been its application to sheet steel annealing, it has already been successfully put to other uses, and the future is

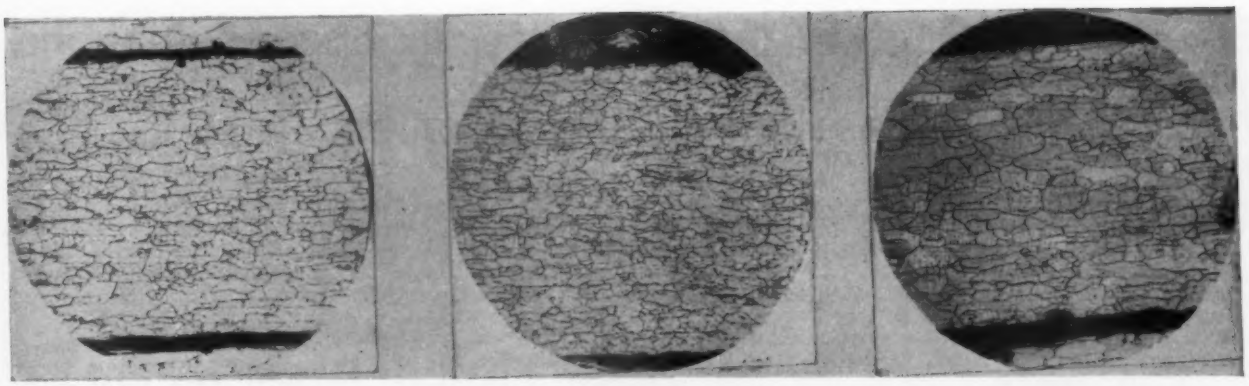


FIG. 10 END 820 M M FIG. 11 CENTER 860 M M FIG. 12 END 850 M M

TOP OF CHARGE

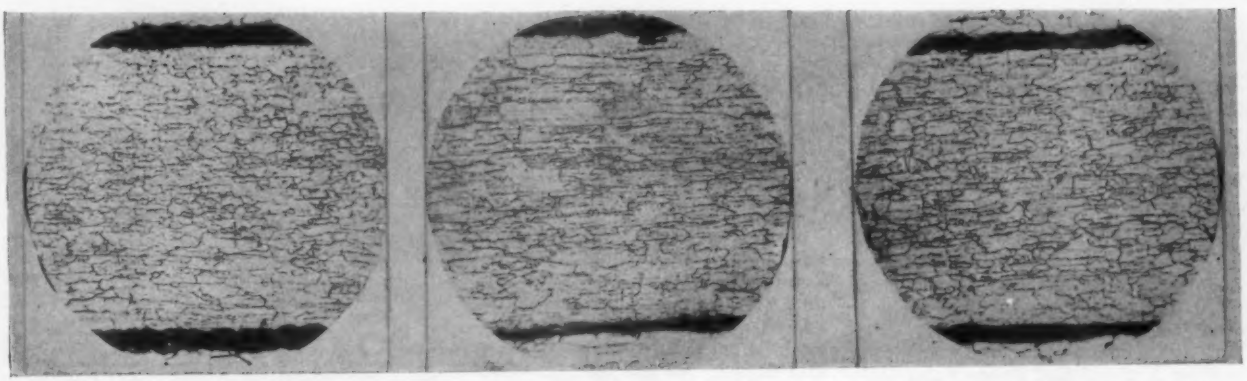


FIG. 13 END 820 M M FIG. 14 CENTER 750 M M FIG. 15 END 830 M M

BOTTOM OF CHARGE

Specimens—Hot Rolled and Box Annealed in Old Type Furnace. Mag. 100. Erichsen Standard, 810 M M

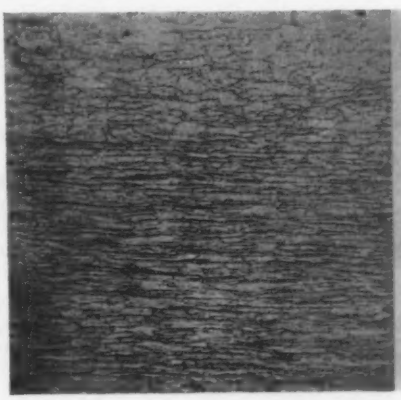


FIG. 16 X100

Specimen—Hot Rolled Only

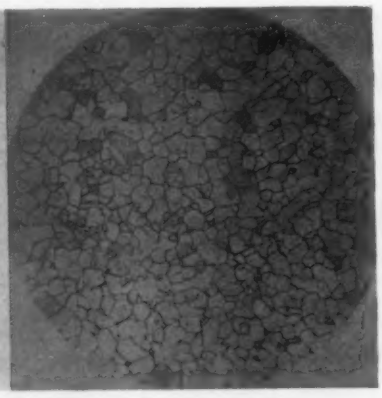


FIG. 17 X100

Specimen—Hot Rolled and Normalized

very promising for gas fired radiant tubes. Besides the rectangular covers here discussed, round type covers heated by radiant tubes have been used for annealing coil strip at about the same temperatures. The annealing of 3½ per cent silicon sheet steel has been successfully done, with long tube life, at a temperature of 1650° F. Tube heated hardening furnaces are now in operation, hardening steel at a temperature of 1600° to 1650°F., with a tube temperature of about 1700°. Malleable annealing is done at a furnace temperature of 1750° F., with a tube temperature of 1850° F. A number of successful installations have been made of gas fired radiant tubes to continuous enameling furnaces, where the furnace temperature is 1600° F. and the tube temperature 1850° F. In at least one instance radiant tubes have been used to heat a large galvanzing pot. Here the ability to distribute the heat evenly, and to apply it to the desired part of the pot resulted in increased pot life and greatly decreased dross. With the progress now being made in improving high temperature alloys it is to be expected that in the near future the permissible range of tube operating temperatures will be increased, and the field for the use of radiant tubes thereby broadened. The development of radiant tubes has given the equipment manufacturer and industrial gas engineer tools to successfully and economically accomplish with gas, heating operations which until this time have been done with other fuels. At no time has the future for the use of industrial gas fuel in heavy industry looked so encouraging as it does right now.

Over $12,000 in Prizes Awarded in Second National Gas Range Sales Contest

Winners in the Second National Gas Range Sales Contest, which closed on July 31, have been notified by R. J. Rutherford, chairman of the Domestic Range Committeee of the Commercial Section which sponsored and conducted the 1936 program to sell modern gas ranges.

By the time the last award check has been forwarded to the winners $12,675 will have been awarded to those salesmen and companies which sold the greatest dollar value of modern gas ranges in their respective competing groups. There were 48 company prizes—18 for the companies selling the greatest dollar value of modern gas ranges during the selected two months period, 18 for companies making the best records during the full six months' contest period, and 12 prizes for those companies making the best records in the sale of automatic oven lighting ranges and time clock control ranges during the contest period.

In addition, a total of 540 $10 awards, or 90 prizes each month, were won by the individual salesmen selling the greatest dollar value of contest type ranges, and 90 awards of $25 to salesmen making the best six months' records.

The 1936 contest was an elaboration of the First National Gas Range Sales contest held during 1935. In that contest each registered gas company selected two months from the four months of March, April, May and June, in which it competed for prize awards. In the contest just closed, each company was again permitted to select two months for intensive campaigning and also competed with others during the entire six months' period. In addition, its individual salesmen were eligible for monthly prize awards.

Gas Company Winners

The following 18 gas companies won prizes varying from $25 to $175 for making the best two months' records during the 1936 contest:

Division 1—United Gas Public Service Co., Houston, Tex.; The Laclede Gas Light Co., St. Louis, Mo.; Cincinnati Gas & Electric Co., Cincinnati, Ohio.

Division 2—The East Ohio Gas Co., Akron, Ohio; The Dayton Power & Light Co., Dayton, Ohio; Atlanta Gas Light Co., Atlanta, Ga.

Division 3—Memphis Power & Light Co., Memphis, Tenn.; Dominion Natural Gas Co., Ltd., Buffalo, N. Y.; Union Light, Heat & Power Co., Covington, Ky.

Division 4—Peoples Natural Gas Co., Omaha, Neb.; Mississippi Power & Light Co., Jackson, Miss.; Houston Natural Gas Co., Houston, Tex.

Division 5—Missouri Natural Gas Co., Farmington, Mo.; Wisconsin Fuel & Light Co., Manitowoc, Wis.; Tyler Gas Service Co., Tyler, Tex.

Division 6—Hutchinson Gas Co., Hutchinson, Minn.; Central Electric & Telephone Co., Sioux City, Ia.; Willmar Gas Co., Willmar, Minn.

The 18 high ranking companies making the best dollar sales records of modern gas ranges during the six months' contest, are given below, prizes varying from $50 to $350 according to the size of the company:

Division 1—United Gas Public Service Co., Houston, Tex.; Southern California Gas Co., Los Angeles, Cal.; Cincinnati Gas & Electric Co., Cincinnati, Ohio.

Division 2—Dayton Power & Light Co., Dayton, Ohio; Atlanta Gas Light Co., Atlanta, Ga.; Dallas Gas Co., Dallas, Tex.

Division 3—Memphis Power & Light Co., Memphis, Tenn.; Union Light, Heat & Power Co., Covington, Ky.; Dominion Natural Gas Co., Ltd., Buffalo, N. Y.

Division 4—Mississippi Power & Light Co., Jackson, Miss.; Rosslyn Gas Co., Clarendon, Va.; Peoples Natural Gas Co., Omaha, Neb.

Division 5—Missouri Natural Gas. Co., Farmington, Mo.; Minnesota Northern Natural Gas Co., Omaha, Neb.; Wisconsin Fuel and Light Co., Manitowoc, Wis.

Division 6—Hutchinson Gas Co., Hutchinson, Minn.; The Keystone Gas Co., Inc., Binghamton, N. Y.; Willmar Gas Co., Willmar, Minn.

Special prizes varying from $50 to $150 were presented to the six companies selling the greatest number of automatic oven lighting ranges and time clock control ranges. Winners in these groups were:

Automatic Oven Lighting Ranges

Division 1—Southern California Gas Co., Los Angeles, Cal.

Division 2—Providence Gas Co., Providence, R. I.

Division 3—Lowell Gas Light Co., Lowell, Mass.

Division 4—Old Colony Gas Co., East Braintree, Mass.

Division 5—Southern Union Gas Co., Bellville, Tex.

Division 6—New York Central Electric Corp., Penn Yan, N. Y.

Time Clock Control Ranges

Division 1—Southern California Gas Co., Los Angeles, Cal.

Division 2—Providence Gas Co., Providence, R. I.

Division 3—The Harrisburg Gas Co., Harrisburg, Pa.

Division 4—Old Colony Gas Co., East Braintree, Mass.

Division 5—Central Pennsylvania Gas Co., Bellefonte, Pa.

Division 6—New York Central Electric Corp., Penn Yan, N. Y.

All gas company winners were selected on the basis of the dollar value of modern gas ranges sold per 100 domestic meters. All winning salesmen were selected on the basis of the total dollar value of ranges sold without regard to the number of meters.

While it is not possible to compare the entire results of the 1936 contest with the previous one, both contests included prizes for best records made during the selected two months' period. In practically every case the companies winning prizes during 1936 showed a large increase in dollar value of ranges sold over the prize winning companies in 1935.

More than 250 companies were registered in the contest, which was underwritten jointly by the American Gas Association and the following range and range accessory manufacturers:

Gas Range Manufacturers

Andes Range & Furnace Corporation, Globe American Corporation, American Stove Company, Cribben and Sexton Company, Detroit-Michigan Stove Company, Estate Stove Company, Glenwood Range Company, James Graham Manufacturing Company, Majestic Manufacturing Company, Moore Corporation, Roberts and Mander Stove Company, George D. Roper Corporation, Standard Gas Equipment Corporation, Tappan Stove Company.

Accessory Manufacturers

American Thermometer Company Grayson Heat Control, Inc., International Nickel Company, Lux Clock Manufacturing Company, Patrol Valve Company, Robertshaw Thermostat Company, Therminsul Corporation of America, Wilcolator Company.

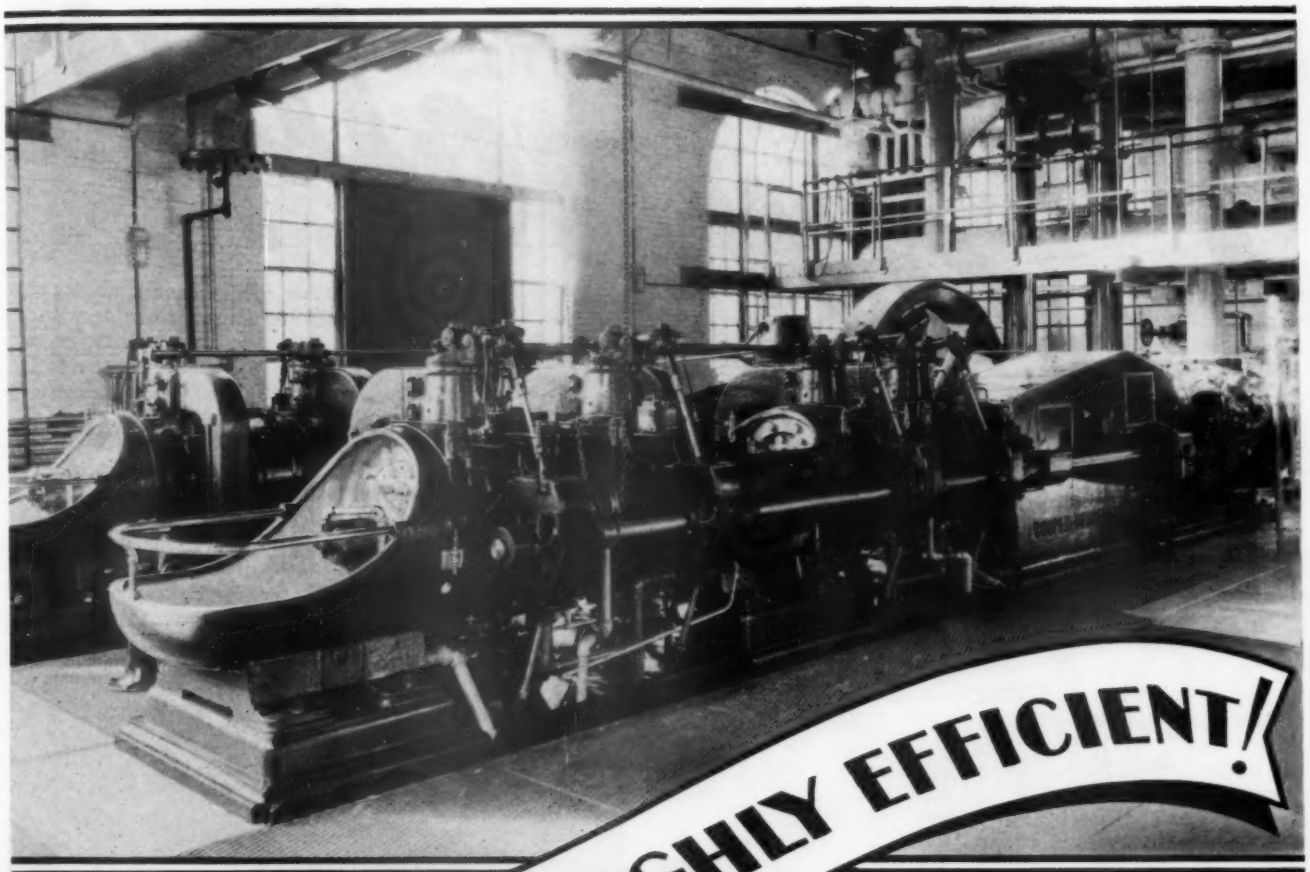
Gas Cock Manufacturers

Detroit Brass & Malleable Works, Harper-Wyman Manufacturing Company, Lincoln Brass Works, Milwaukee Gas Specialty Company, Roberts Brass Manufacturing Company, W. J. Schoenberger Company.

The Committee in charge of the Contest was headed up by Mr. R. J. Rutherford, Worcester Gas Light Company, Worcester, Massachusetts.

Awards at Convention

In addition to receiving large cash awards, the prize winning companies will receive a special award certificate, suitable for framing and mounting in the companies' offices. The six gas companies winning first prize for the best sales records during the entire six months' period will receive their award certificates at a Special Prize Session of the Commercial Section to be held in Atlantic City on the afternoon of Wednesday, October 28.



COOPER-BESSEMER UNIT SERVES N. Y. SUBURBS

THE Westchester Lighting Company is installing a Cooper-Bessemer compressor unit (reciprocating type). The efficiency is much higher than that of a rotary-type blower, for this kind of work. There are also no high stand-by charges when the unit is not operating.

Self-contained, the new unit is a Type-19 twin-tandem gas-engine-driven gas compressor, with a capacity of 982,000 cu. ft. per hour. The four-cycle gas engine direct-drives two 49" dia. x 24" stroke compressor cylinders.

An equally efficient installation was made previously at a Flushing (N.Y.) station — shown in photograph above.

It will *pay* you to investigate the demonstrated earning power of Cooper-Bessemer compressor units. We build a type and a size best suited to your needs. Our representative would like very much to tell you about it. Call him in.

THE COOPER-BESSEMER CORPORATION

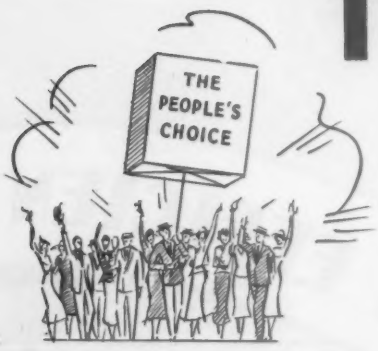
Mount Vernon, Ohio — PLANTS — Grove City, Pennsylvania

25 West 43rd Street, New York City · Mills Building, Washington, D.C. · 640 East 61st Street, Los Angeles, Calif. · 201 East 1st Street, Tulsa, Oklahoma · 631 Spring Street, Shreveport, La. · Magnolia Building, Dallas, Texas · Esperson Building, Houston, Texas

Campaign

with this load builder and good-will builder

THIS FALL!

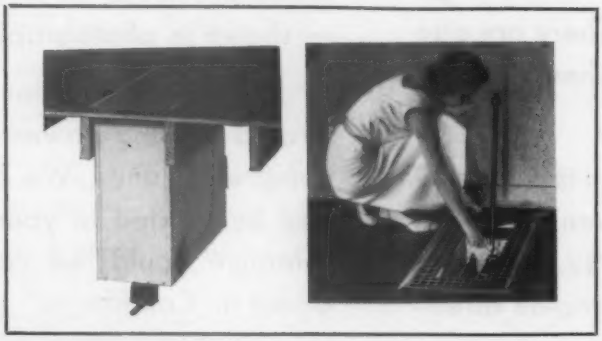


HERE is the gas heater that responds to promotion — the smart heat-making, friend-making Estate Heatrola. Beautiful to look at, economical in operation, this modern heater has introduced the advantages of automatic gas heating into thousands of homes and apartments, offices and stores. A wealth of talking points makes the Estate Gas Heatrola a natural on the showroom floor and for outside selling. Three sizes, including a new, smaller model with 20,000 B.T.U. input. Write for new catalogue today.

THE ESTATE STOVE COMPANY, HAMILTON, OHIO

ONE MATCH
TO STRIKE . . .
ONE DIAL TO SET . . .

and your customer's heating job is done for the winter! No wonder smart gas merchandising men are concentrating on the smart Estate Gas Heatrola!



ESTATE IN-A-FLOOR HEATROLA

The powerful circulating heater which is sweeping into popularity for use in homes, offices and stores. Requires no cellar, yet takes up no space above the floor. Built into the floor, between joists. Only the register face is visable and all control is *from above.*

WE'LL BE SEEING YOU IN **ATLANTIC CITY** SPACES 324-325-326 • AND WE'LL HAVE A LOT FOR YOU TO SEE

ESTATE *Gas* HEATROLA

Year-Around Planning Brings Outstanding Results for Utah Firm

By Lucius S. Flint

IN planning their merchandising program for the coming year, gas companies would do well to consider the merits of an unusual, year-around appliance sales distribution plan developed by the Mountain Fuel Supply Co., gas company at Salt Lake City, Utah.

Despite unusually keen competition from other strongly established fuels, this property has made some remarkable gains under this system of operation. For example, water heater sales were increased more than 100% and range sales by more than 60%.

Those gains are due in a good measure to long-range planning covering the complete line of appliances. Instead of concentrating on just certain appliances during the seasonable periods, this company has covered the whole load-building picture as one unit. That applies to setting up quotas, to advertising and so on.

The system has served two important purposes: it has made the public gas conscious in a territory where other fuels had formerly predominated and it has brought the complete line of appliances to public attention in a very effective manner with a comparatively small merchandising investment. One appliance has been tied right in with the next so that each helps the other and both promote the gas idea.

Let's see how the system works. Since there is normally comparatively little activity during this period, January and February are devoted to clearance sales on the whole line of merchandise. In March, quotas for the entire year are set on the complete line of merchandise.

For example, a water heater quota of 100 units per man for the year is set instead of a quota of 30 or 35 units per month for three months—the usual system.

"There are several reasons why a full year quota is better than a monthly or seasonable one," says S. E. Cowan, sales and advertising manager. "In the first place, it is easy to misgauge a seasonable campaign. If the weather doesn't happen to 'break' right to tie in with the planned drive, the whole thing is thrown off schedule and much of its effectiveness is lost.

"When a quota is set early—on a yearly basis—the men start developing their leads for that appliance far in advance and actually selling a good many units before the season proper starts. They have more or less of a 'head start,' both in actual sales and in planning. Then, if for any reason they don't quite make quota during the season proper, they will go ahead and work hard on the item and probably develop enough post-season business to make up for the seasonable deficiency.

"When the men are working the complete appliance line the year around, they also cultivate each customer thoroughly. When they go in on one appliance, they do their best to sell another, even though it may not be the season for the latter. In any case, they are thinking ahead and have a lead on the second sale clearly in mind for the season when it does arrive. Where only one appliance is worked at a time in a seasonable campaign, there is likely to be a lack of proper cultivation of every individual customer.

"It's certain that the general load-building job can be carried out more economically this way than with strictly seasonable campaigns."

Rental Plan on Water Heaters

A rental plan played one of the most important parts in the hot water heater selling activity. Heaters were sold on a 60 day free trial basis—which gave the customer a chance to observe costs of operation on one full gas bill. If the heater was left in at the end of 60 days, it became a full-fledged rental contract. If at any time during the 30 month payment period, a heater is taken out, the rental feature holds—in other words, the customer doesn't assume any liability. If the customer pays the full price of the heater, the merchandise is his.

Last year, the returns were considerably less than 1%. Of the 856 water heaters sold last year, 432 or about 50.5% were on rental contracts. The others were sold for cash or on a regular payment contract.

Contrary to the feeling of some properties that a danger exists here, the rental plan didn't interfere in the least with cash or regular contract sales. The business done on a rental basis was mostly extra business—with people who due to lack of experience with gas, use of other equipment or other similar reasons, wouldn't have installed gas equipment except on a rental basis.

Advertising Alternated

The company's year-around advertising campaign is handled with the same idea in mind as that used in setting the quotas. Newspaper ads are alternated. One ad is devoted to refrigeration, one to water heaters, one to heating, one to cooling, one to ranges and so on. That alternation program carries through all during the year, even though the appliances featured aren't seasonable at the time they are advertised. They are constantly kept in the public eye and interest in them is created for the next seasonable period.

While each ad features just one appliance, all of them indirectly promote the idea of gas for all purposes.

Employee Cooperative Plan

Another thing that has increased appliance sales for the Salt Lake property and done a great deal to promote organization-wide good will and interest has been an unusual type of cooperative program, recently launched. The organization is divided up into 12 groups of not more than 12 people each. The different teams are made up of employees from all departments. Each group works against the others in a competition on promotion of new business.

Each team has a salesman sponsor whose duty it is to hold meetings for the group, advise them on how to get leads and otherwise help them in their "tip" work. The salesmen team captains or sponsors are responsible to the members of their groups for the leads furnished by the group members. He must follow them up, sell the merchandise if possible and report back on the results. Wherever a salesman considers this advisable, he may ask the member of his group who furnished the lead to go out with him on the call.

Weekly bulletins are put out giving the standings of the different teams and the standings of some of the outstanding individuals on those teams.

Small group prizes are set up from time to time for the members of the winning teams. For instance, a day off for the group or a trip to the gas wells.

In the first 20 days after the plan was launched, 635 appliance tips had been turned in, from which 20 new customers had been gotten and 151 appliance sales made.

Since nearly every employee on each team is from a different department, members of different divisions are given a chance to get acquainted and understand each others problems in a very helpful, valuable way. Many sources of disagreement are eliminated by this friendly acquaintance.

These Boulder, Colo., Gas Appliance Salesmen Can Cook!

By John T. Bartlett

GLENN A. PRATT, sales manager of the Public Service Co. of Colorado, at Boulder, Colo., encourages his salesmen to study the cookery art. Fundamentally, as Mr. Pratt views the matter, there is no reason at all why a gas range salesman should not, as he masters range salesmanship, master the technique of cooking and baking with a gas range. Four out of five of his salesmen Mr. Pratt calls very good cooks.

These men not only turn their expert knowledge to effective use in daily selling, but actually put on a very successful cookery school.

The company hired for the school vacant store premises in a central location, and advertised a three-day event, with two-hour sessions each afternoon. A platform was installed at the far end of the room. Chairs were rented.

Glenn Pratt, sales manager, opened and closed the daily school, but the "heavy work" was done by the salesmen.

In the center of the platform, at front, was a table of good size. On one side, near the wall, was one gas range, and a second range occupied position which somewhat corresponded on the opposite side. There was a third range in the floor directly in front of the work-table. On the platform, too, was a refrigerator. The ranges exhibited and demonstrated sold, respectively, at $152.50, $97.50, and $74.50.

Garrett Craig and Edwin Morrill were the salesmen who, in the school, were combined cook-lecturers. Eddie Green, a third salesman, functioned as special lecturer. Clark McSpadden was special refrigerator lecturer.

The "performance" which these four salesmen put on was cleverly arranged to inject plenty of variety, and to yield greatest effectiveness.

One cook would lecture in relation to a cake, for example, he was making. The other cook would then come in with a talk stressing principles of gas range cookery—as well as the great advantages. While both cooks were benefitting from a "rest period," the special lecturer, Eddie Green, would talk interestingly to the audience. Every afternoon, too, the refrigerator specialist gave a brief lecture.

Time and temperature were two points which, constantly, the cook-lecturer emphasized. As the baking process was about to begin, for example, Mr. Craig would announce that the time required for perfect results was so-and-so. He would request the audience to remember that. And promptly on the tick, he would remove the pan.

Later, sampling, the audience would acclaim the delicious product.

Time and temperature! Throughout the three days, the sales crew hammered away on these themes, selling acceptance of the great convenience, efficiency, and scientific accuracy, of the gas range.

There was a question period each afternoon. One of the interesting things was the surprise of some of the ladies at the salesmen's proficiency. Almost literally, they came to laugh and ridicule, and remained to pay homage.

Although the salesmen only started to prepare for the school about a week in advance, they put things over with a bang, and drew very responsive and productive audiences of a hundred or so each afternoon.

Not only were many excellent leads secured, but the salesmen, from the fact that they had demonstrated and lectured before the prospects, already had a "head start" as it were in the race for a sale.

The "cooking salesmen" will extract maximum advantage from the new model kitchen being completed in the Public Service Company's Boulder sales room. They will be ready-set, with a minimum of notice, to put on a cooking demonstration for an individual prospect or making it an invitation affair, for a group. This model kitchen, also, will add to the value of visits of the high school home economics class, and University of Colorado classes —annual affairs.

The Company's remodeling operations, in fact, will give gas appliances a much better opportunity than they have had in the past. Formerly, there was a single display window, which both gas and electric appliances were displayed in. Now, there are two display windows, each approximately 8 feet deep, and 18 feet wide. One of these is used exclusively for gas merchandise.

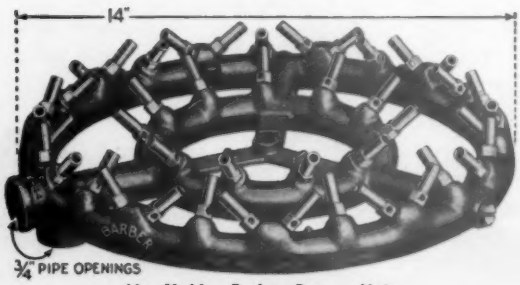
The model kitchen is on a 6-inch platform in one corner of the sales floor, and occupies space approximately 10 x 14 feet. It has every modern feature throughout.

The Public Service Co. is both a gas and an electric utility, and, in the model kitchen, space for the range will be occupied alternately by the gas, and an electric range. However, when an electric range is in use in the kitchen, adjoining space on the floor, near the side wall, will be occupied by a modern gas range, ready for operation. Accordingly, it will always be possible to show the electric range prospect just what the gas range offers the housewife.

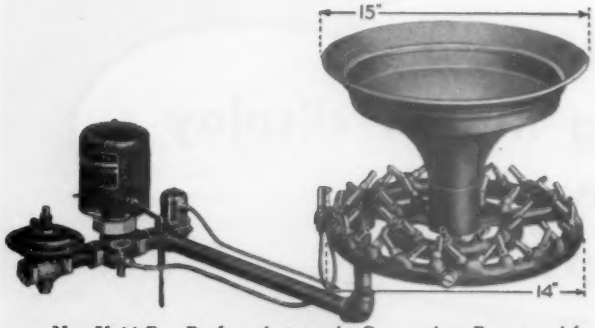
The "cooking salesmen" are enthusiastic users of the model kitchen

...“and
who will show
the most interesting heater display
at the convention,
Princess Goloop?”
See Booths
221-222
for the
Answer
A.G.A.
CONVENTION
Oct. 26-30
ATLANTIC CITY
NEW JERSEY

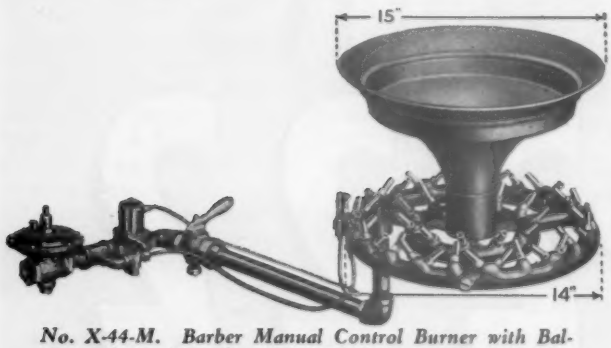
BARBER BURNERS *Presenting* **NEW** *Styles in* ROUND BURNER *Models*



No. X-44. Barber Burner Unit



No. X-44-B. Barber Automatic Conversion Burner with Baltimore Safety Pilot Control. With semi-steel Flame Deflector and Ring; Motor Gas Valve; Plain Room Thermostat; Baltimore Automatic Shut-off; Pilot Light; Butterfly Draft Door Assembly; Lower Buffles; Gas Pressure Regulator; Shut-off Valve, and 25 feet insulated wiring.



No. X-44-M. Barber Manual Control Burner with Baltimore Safety Pilot Control. With Semi-steel Flame Deflector and Ring; Baltimore Shut-off; Pilot Light; Lower Baffles; Gas Pressure Regulator and A.G.A. Shut-off Valve with Union.

BARBER Conversion Burners, now as always, lead the field. As further evidence of this, Barber now presents NEW and greatly improved designs for *round* furnaces and boilers, with grates up to and including 20 inches in diameter.

We say without exaggeration that NO other Gas Conversion Burner can be *properly* installed in *less time* than these new Barber Burners. The reason is the *exclusive* construction features, found in no other burner.

These new assemblies can be supplied for completely automatic operation with Motor Gas Valve, or Magnetic Valve—or for Manual Control. Heat is deflected to sidewalls by a Semi-steel Deflector and Deflector Ring—a flame-scrubbing action that means high efficiency and economy. No refractory elements to replace.

Here, at last, is a *moderate* priced burner which has genuine merits not often found even in *higher-priced* competitive equipment.

•

Examine these new burners! Write at once for Illustrated Descriptive Bulletin and Price List.

•

See the Barber Burner Exhibit at the A.G.A. Convention in Atlantic City

THE BARBER GAS BURNER CO.
3704 Superior Ave., Cleveland, O.

•

Address Michigan Inquiries to
The Barber Gas Burner Co. of Michigan
4475 Cass Ave. Detroit, Michigan

BARBER *Automatic* JET GAS BURNERS

For Warm Air Furnaces, Steam & Hot Water Boilers, & Other Heating Appliances

Domestic Gas Utilization

Range Division

Top Burners—Part V

By

Charles W. Merriam, Jr.

Manager, Lynchburg Gas Company, Lynchburg, Virginia

IN the parlance of a retail salesman the word "build-up" implies a process of mental and emotional appeal to the prospect which, if successful, culminates in an order. The build-up might conceivably be approached in numerous ways, depending upon the prospect, the salesman and the situation. That general method most widely employed after the attention and interest of the prospect have been secured is to first assert the aesthetic, mechanical and economic virtues in brief broad outlines. Then, by expanding the individual points of strength, figuratively speaking, build up deftly and precisely an enclosing wall, stone by stone, from which there is no escape for the prospect. Where the reaction of the prospect suggests hesitancy or doubt, factual proof must be convincingly offered, not to win arguments but to stimulate conviction. The next step is obviously to re-emphasize in summary those points most likely to persuade the individual prospect—and then *move to action.* All non-essentials that can with propriety be dispensed with in reaching that final conclusive *move to action,* the better. In the rough, this is the build-up, a preconceived and objective program directed toward the goal of a signed order.[1]

In the two previous articles treating with the basic principles governing top burner performance and characteristics, we have been, figuratively speaking, building up to the final step of comparing gas consumptions of the star with the round type of burner for similar conditions of operation. In the somewhat devious route followed irrefutable evidence has been advanced to establish why the newer round type was inevitably better. Of primary importance now is how much better is the new than the old? The public being in the main inquiring buyers, demand exact information as to the probable savings in gas bills attributable to the utilization improvements inherent in the round burner. Cleanliness, heat distribution, appearance, all of these are impressive to *Mrs. Modern,* but hardheadedness prompts interest in the actual monthly nickels and dimes.

Comparative Efficiencies

The accompanying chart presents the answer to the relative merits of the round and the star type of top burner in terms of gas consumption for a given task. Two burners were set at proper heat input rating (9,000 Btu. per hr.) with optimum adjustment, all at an arbitrarily choosen 3.5" manifold pressure. A standard A. G. A. test pan containing 5 lb. of water was raised through 140°, that is, from 60° to 200°. The gas actually consumed on the round type was 1,535 Btu., whereas on the star type the consumption was 1,960 Btu., thus establishing that under the conditions of this test the star type required 425 Btu. more to accomplish identically the same useful work. The round burner then may be said to take 425 ÷ 1960 = 21.7% less gas than the star type. A gas saving of this magnitude is something worth talking about, particularly inasmuch as the bulk of the average home cooking is done on the top burners.

The observant will turn another phase of this test case to good advantage. The burners used were positively clean and in accurate adjustment. The star burner had raised ports and was generally of a design superior in efficiency to most similar type burners now in customer service. Common sense establishes that due to the fact that the round is both more difficult to get dirty and easier to clean, its efficiency is more apt to be sustained under casual home conditions than on the star type of burner. The conclusion is safe that on the average the round burner will effect a saving well in excess of 20%, provided the same amount of cooking is done in the same manner. Salesmen should take particular note of this last statement regarding the full extent of the percentage saving being dependent upon the customer operating the new range identically similar to the previous range. Unqualified or exaggerated claims of economy will inevitably result in repercussions—and the improved burner is so good as to evoke genuine enthusiasm.[2]

Salesmen prone to putting their best foot forward, will indulge in even more figuring. Calculations on the foregoing test results establish thermal efficiencies at optimum adjustment of 37.3% on the star type and 47.6% on the round type. Then, 47.6 − 37.3 ÷ 37.3 = 10.3 ÷ 37.3 = 27.6%, thus supporting the statement that the round burner is 27.6% more efficient than the star type. Compared with the 21.7% saving as shown above, this 27.6% more effi-

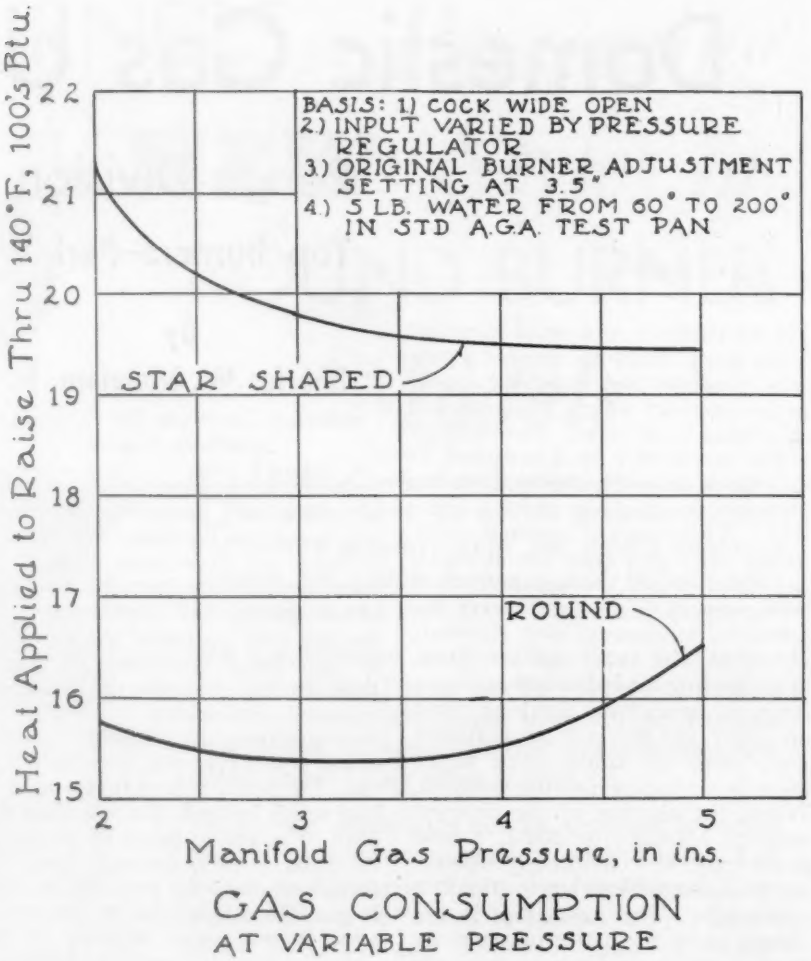
[1] *It is an appropriate commentary on the Gas Industry to observe how much more mental rather than emotional the prevalent approach to the sales problem is. Sales by logistics is apparently the only course known to most managements, the assumption being that because the preponderance of natural as well as man-made advantages favor the acceptance of gas service, the public should by all that is* good and holy *eagerly welcome our salesmen with open arms as a follow-up to some* come-on *price advertising. Without attempting to discredit the virtues of a rationalized prospect approach, the assertion can be made that failure to dramatize our appeal emotionally involves failure to capitalize on the strongest buying urge of the public. Our electric competitors, sorely handicapped by inherent and inescapable disadvantages, have still made a distressingly effective approach almost entirely along emotional avenues. As silly as it might sound in black and white, it is nevertheless a verity that rich indeed is the gas salesman who, armed with the incontrovertible facts, can in addition strike harmonious chords on the heart strings of his prospects. We need more "painting of the lily"—and how to acquire this elusive art?—you must be born with an aptitude for the romantic version, but it can be cultivated artificially with difficulty in a greenhouse.*

[2] *See next page.*

cient figure sounds more enticing. There can, therefore, be different answers to questions of savings and relative efficiencies. This is mathematical juggling that must be employed with discretion, in that, an unsophisticated prospect might be misled.

In this test as conducted both burners were set with an hourly input rate of 9,000 Btu. Knowing that the round burner is 27.6% more efficient than the star type, the deduction can be made that it is correspondingly more rapid in accomplishing work. In other words, at equal inputs the round type is measurably speedier. Incidentally, there is much apparently authentic electric propaganda currently in circulation whose conclusions as to both speed and relative fuel costs are based upon the antiquated star type gas burner at standard input ratings or less. However, for some inexplicable reason, there is a perceptible tendency for fitters to step up the heat input of the old star burners above the standard rating.[3]

Observe in this "Gas Consumption" chart that the point at which burner adjustment was made was selected at 3.5". Substantially similar results could have been obtained if perfect adjustment had been made at any other normal pressure (3.0" to 8.0"). Common sense dictates the conclusion that because a burner operates with the maximum efficiency at the adjustment pressure, care should be exercised in making the original adjustment at as close to the average manifold pressure as possible. Note in this chart that fluctuations on the high side from the adjustment pressure affect the round burner more adversely than the star type, a circumstance doubtless caused by the angle of flame emission from the round burner. This is equivalent to saying "don't over-gas the round burner."



GAS CONSUMPTION
AT VARIABLE PRESSURE

[3] *Some executives subscribe to the belief that the sale of the more efficient, modern range reduces gas consumption, which is, of course, from a business viewpoint a step in the wrong direction; thus, in some quarters the sale of ranges is held to be in the defensive category. In many individual instances a new range will actually diminish the gas bill. Numerous field studies have established what is an apparent paradoxical situation, namely, that in the aggregate the more efficient range has by itself increased the average gas bill by a slight amount. Here are a few explanations: 1) Attractiveness makes cooking more inviting, thus withdrawing patronage from the delicatessen store, the canner and the staple baker; 2) pilot light gas added when the meter is sufficiently sensitive to record such small rates of usage; 3) time-temperature recipe books suggest attempts to create fancy pastries, cakes and whatnots in the belief that the heat control transforms the inexperienced amateur into an accomplished professional; 4) broiling, which is productive of healthful and appetitizing foods, is made much easier and more inviting although from a gas consumption standpoint the process is a little hard on the purse. In addition to the small increase directly assignable to the range, there exists the not inconsiderable factor of the enthusiastically satisfied cook having a higher susceptibility to the purchase of an automatic gas water heater and a gas refrigerator.*

[3] *One of the most effective* come-on *stunts in the game is the use of the so-called kitchen demonstration burner usually in a special chronium or nickel finish. This method of approach is facilitated by a regular round burner, the same being readily attachable to an old stove with the aid of an adjustable extension bracket to temporarily support the demonstration burner at the proper height. By this means* entree *into the home is easier and in addition, an exceedingly persuasive sales talk can be launched. Usually a readjustment has to be made on the orifice spud which, by reducing the gas flow with the liberation of an equal amount of heat as with the former star burner, offers substantial proof to the housewife of increased efficiency. The catch, of course, is that a new range must be purchased in order to enjoy the advantages of the improved burner.*

Flexibility

"Finger tip control", "a thousand heats" and "supreme accuracy" have taken positions in the first stanza of the battle cry of the Gas Industry in the domestic range market. To be sure, for a decade this fundamental characteristic of the gas top burner was scarcely deemed worthy of mention until our electric colleagues startled the world with the bombastic statement that "electric economy is due to high - medium - low switch positions." In the present era those essentially exclusive gas features, instant availability of heat, precise control of cooking temperatures and virtually instant heat discontinuance, assume significant proportions in the competitive field.[4] These advantages of gas are even more pronounced when compared to solid fuels. Without delving into the mys-

[4] *Careful electric cooking includes the turning off of the switch several minutes before completing a cooking operation in order that the vessel might absorb usefully the retained heat in the coil, ceramic bedding or plate—a really* guess-as-guess-can *process.*

See these NEW DEVELOPMENTS in gas cooking appliances at S.G.E.'s EXHIBIT (BOOTHS 321, 322, 323)

• We feel certain you'll find the S.G.E. Exhibit a highly educational one—replete with revelations on what has been accomplished in the past year to make gas the dominant fuel for all types of domestic and commercial cooking.

Illustrated are only a few of the outstanding S.G.E. appliances which in the past few months have been gaining new prestige and new consumers for gas—and winning the load for gas.

Gas companies are finding that these and other S.G.E. appliances (which you will see at our comprehensive Convention Exhibit) supply them conclusive sales evidence that gas can do it better—more quickly, more efficiently.

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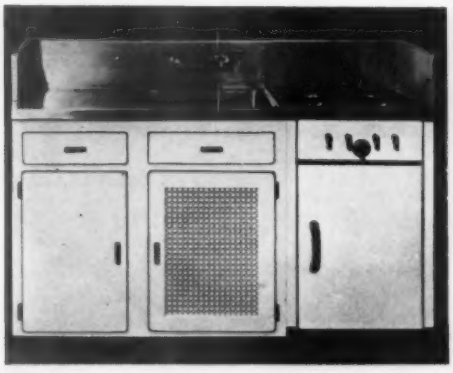
THE FOUR ACES. Four new domestic ranges that have aroused intense interest. Designed to harmonize with the new refrigerators.

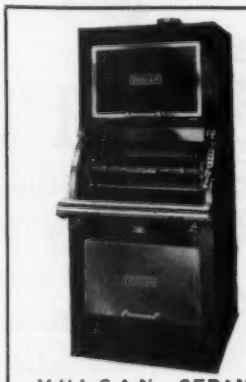


NEW APARTMENT UNIT. See the range that won the battle of gas vs. electric cooking in America's smartest apartments at Radio City.

THE NEW SMOOTHTOPS. Now have enameled tops and many other new features. Use SMOOTHTOP to help you beat electric competition.

NEW VULCAN FRYERS. Just announced, but already are the sensation of the industry, as indicated by a flood of orders. Many new improvements, including insulated combustion chamber and immersed flues.

VULCAN RADIAL FIN TOP. The greatest improvement in heavy duty gas ranges since the original "All-Hot-Top." Faster, more economical and provides greater hot working surface. See the animated display at our exhibit.



VULCAN CERAMIC BROILERS. Radiant ceramic burners do a far superior broiling job. Because of their speed, 35% more work is done in a given time. See the new broiler and you'll understand why it is rapidly replacing all others.

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Make a note to see the AGP exhibit when you attend the convention or write to us for complete information. You will find that featuring the AGP line is one of the best ways to build profitable gas loads in your community.

DE LUXE SERIES D AGP *Gas-Fired Air Conditioning Unit. Beautifully designed cabinet of heavy steel with rounded corners in gunmetal enamel with light green trim. In four sizes with 140,000 to 350,000 B.T.U. hourly input. Cleans, humidifies, warms, and circulates the air.*

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teries of dietetics, the observation might be here introduced that the principal factor in the possible retention of maximum food vitamin content in top cooking is flexibility of heat control. At least, insofar as fuel for top cooking is concerned, the electric plea as to superior qualities of vitamin preservation, or for that matter, the sentimental remembrances of the delicious foods concocted by Ma on the ol' wood stove back on the farm, is so much idle chatter because the flexibility of gas top burners offers opportunity for unmatched *quality cooking.*[5]

One aspect of the round gas burner which does not have broad appreciation even within the Industry is the remarkable uniformity of efficiency over a wide range of heat inputs. Illustrating this aspect of burner operation the accompanying chart, "Gas Burner Efficiency of Round Type", is presented. Observe that the thermal efficiency is scarcely affected by turning the gas cock from on full at 9,000 Btu. per hr. input down to a rate as low as 2,700 Btu., the efficiency falling from 47.6% to to 46% on reducing from full speed to 30% of capacity. Even at 1,000 Btu. input, or 11% of full capacity, the thermal efficiency has only fallen off 29%. However, few burners operate without danger of flash-back or extinguishment at less than 15 to 20% of rating, i.e., around 1,200 to 2,000 Btu. input. In other words, the sacrifice in efficiency by operating at low input is small indeed, a remarkable characteristic. The proable continuity of efficiency under field conditions with the round burner surpasses that of the star type to a measurable extent. In a like manner, lower turn-downs can be achieved with the round type than with the old-fashioned star burner due to the basic differences in design.

Advantages Summarized

Summarizing the advantages of the round or circular burner as compared to the star shaped, the following, as brought out in the previous paragraphs, constitute the chief improvements:

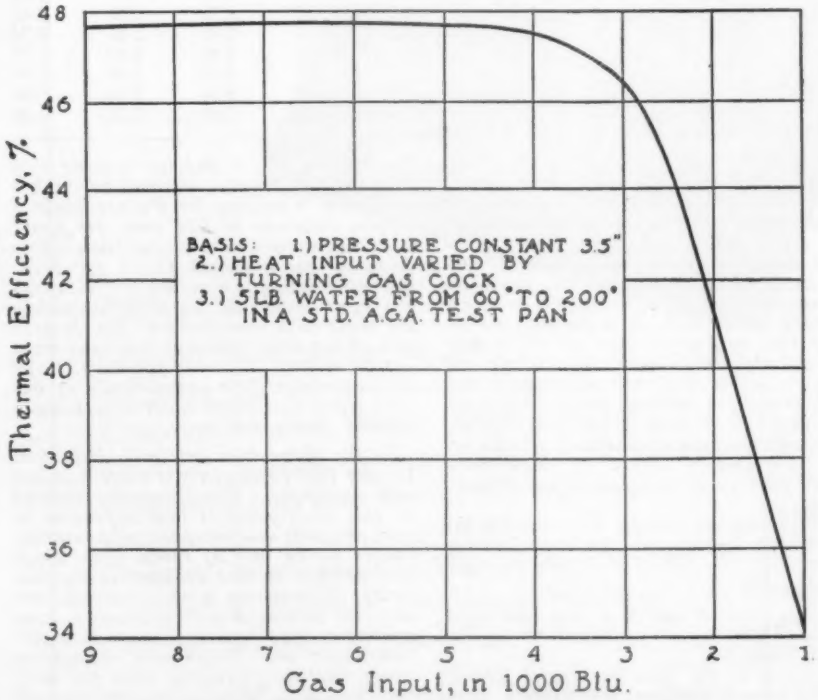
1. Less gas consumption for any given job.
2. Greater uniformity of efficiency over range of possible heat inputs.
3. Lower turn down.
4. Readier ignition.
5. More difficult to get dirty.
6. Easier to get clean.
7. Cleanliness (see 5 and 6) tends toward greater retention of original efficiency.
8. Small pans better accommodated.
9. Increased efficiency reduces heat liberated into kitchen.
10. Better heat distribution.
11. Appearance.

Salesmen, imprint these virtues of the round burner in your minds—your prospects have appreciation for such tangible, demonstrable and worthwhile improvements in the art and science of homemaking.[6]

Double Head Burner

Before closing the chapter on top burners, consideration might well be given to the double head type of burner in which a small or "simmer" burner is incorporated within the main burner. Of the various types on the market that shown in the accompanying drawing is the most widely used at present. Inspection will indicate that two separate entrainment tubes are employed, one to conduct gas to the outer or main circle of ports and a second to the inner circle or simmer portion. The removeable head is partitioned off inside in such a manner that when gas travels along only the tube leading to the simmer, gas can emerge only from the simmer ports. When gas flows through the mixing tube to the main burner then, gas is also burning in the simmer. Thus the simmer may burn separately, but when the main burner is on the simmer is also. A single three way gas cock controls the gas entering both entrainment tubes.

This type of burner has a maximum rating of 1800 Btu. per hr. on the simmer, whereas although the outer ring of ports is rated at 7200 Btu. this together with the simultaneously burning simmer, presents a total rating of the standard 9000 Btu. per hr. This arrangement permits a practical range of inputs of from as low as 300 Btu. up to full capacity at 9000 Btu. per hr., thus increasing the permissible turn down in comparison to the ordinary burner. The cock is so designed that an au-

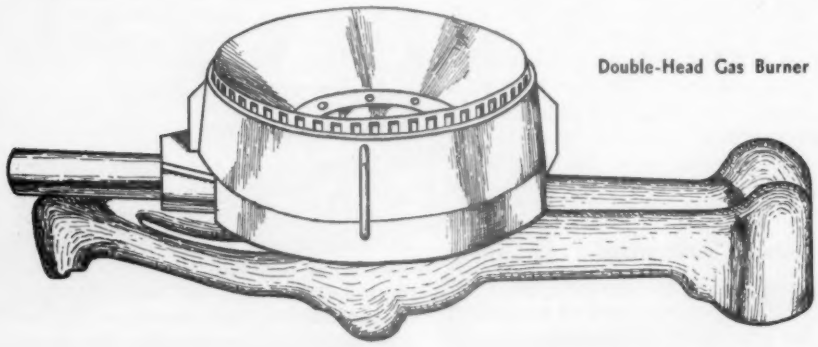


GAS BURNER EFFICIENCY OF ROUND TYPE

[5] *The electric industry's propensity to select a weak link in the chain as the feature to be transformed into a cardinal virtue by glamorous advertising, is an interesting psychological twist. Apropos of this unique quirk are "High—Low—Medium Switch", "Marconi discovered radio electrically—cook with modern speed," "Vitamin retention (only possible electrically) is essential to child health", "Monitor Top, the 'patented' dust catcher", and "Longevity with Only Three Moving Parts", and "This Time buy a Permanent Refrigerator". Perhaps by baldly claiming and asserting merit, conscious effort is indulged in to cover up unfortunate trade obstacles, on the assumption that only the weak need defense.*

[6] *The author is indebted to the Glenwood Range Company in whose laboratories the data on which the two above charts are based, was developed.*

dible snap or click sound occurs when the handle is turned from simmer to main burner or vice versa. It can be asserted that the simmer on full has an improvised efficiency over a regular burner at a similar heat input.[7]



Double-Head Gas Burner

Fuel Economy

"Not the use but the abuse" of gas in the process of cooking is costly. Getting right down to cases in the normal home the total gas bill for cooking is less than one tenth part—in many instances less than one twentieth part—of the monthly food bill. And yet there are few homes in which the strictest economy by the operator would not lower the gas usage by 20% at a minimum. A few of the recognized economies widely preached by alert gas companies everywhere to housewives in attempts to foster more satisfactory top burner service, are as follows:

1. Keep burners clean.
2. Use minimum water requirements.
3. Employ lids or covers persistently.
4. Do not over-cook foods.
5. Turn down burner to just sustain boiling.
6. Light burner after vessel is in place.
7. Extinguish burner upon removal of vessel.
8. Manage meals to complete individual dishes as close as possible to serving time.

Ah, those unprobed recesses of human mind governing habit—here are eight simple maxims of fuel economy which nearly everyone recognizes but few practice. Competent authorities state that if the same degree of care was used in gas kitchens as in electric "dream house culinary departments", the stock holders of gas companies would be in for some woefully lean years. Contrary to this, however, is the bulwark that because gas is relatively inexpensive the public can continue to indulge its shiftless lack of intelligent thrift without catastrophe.[8]

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[7] *Enthusiasts for this type of double head burner advance the theory that such control at extremely low inputs is possible that waterless cooking is greatly facilitated. Although this claim is doubtless true for the cooking of exceeding small food quantities the theory in general is doubtless more academic than actual. Very low turn downs permit keeping foods warm with a minimum of further cooking while awaiting being served. Nevertheless in the hands of a forceful salesman this type of burner offers real opportunities for showmanship particularly if the cooking is done by a servant.*

[8] *Wide variations in unit prices, thermal values, methods of application, cooking use, etc. exist which makes determinations of the exact cost of gas relative to that with other fuels an exceedingly difficult undertaking. Depending upon what and by whom an answer is being sought most any kind of a result can be secured thereby demonstrating that figures can lie and liars figure. Although from an admittedly biased source, the conclusions reached by the American Gas Association in their Bulletin No. 6 are the most factual and conclusive of any available. In searching tests, as there reported, the energy ratios (the heat in Btu. supplied by gas divided by the heat in Btu. supplied by electricity) may with a reasonable degree of assurance be relied upon as follows:*

Item	*Scope of Test*	*Energy Ratio*
1.	Top burner performance	1.532
2.	Oven performance	2.624
3.	Week's menu (upper income)	2.077
4.	Week's menu (limited income)	1.799
5.	Food for Infant	1.754

Any one can take their choice of the above depending upon the field conditions encountered. It is worthwhile in connection with the above to observe that the tests were conducted upon gas ranges with circular burners of recent design and regular insulated—heat controlled ovens, and new electric ranges before oxidation of the elements had advanced appreciably. It is further significant that when feasible the electric oven was used in preference to the top elements and that where electric top burners were employed extreme care was brought to bear in the manipulation of the high-low-medium switch to effect the most economical operation possible—in short the electric range was given advantage to an extent not likely to be accorded in the field. It is the author's belief that an energy ratio of 1.9 is conservatively representative of electric and gas ranges at their present stage of development for aevrage home conditions. Comparison of items 1 and 2 readily establishes the reason in back of astute electric distributors advocating whole meal oven cookery despite educational difficulties.

Accepting an energy ratio of 1.9 the following formula will facilitate calculators:

$$\frac{1.9 \times 3413}{\text{Btu. of gas to 1 Kwh.}} = \text{cu. ft. of gas equivalent}$$

in which if 525 Btu. per cu. ft. gas is being burned, then by substitution

$$\frac{1.9 \times 3413}{325} = 12.35 \text{ cu. ft. of gas equivalent to 1 Kwh.}$$

With the foregoing as a basis, the tabulation below represents the "break even" gas cost per Mcf. for electricity at different costs per Kwh., fuel cost only being considered on a 1.9 energy ratio.

Cost per Kwh., cents	*Break-even Cost per Mcf. Btu. of gas per cu. ft.*					
	500	525	550	750	1000	1100
1.0	$0.77	$0.81	$0.85	$1.16	$1.54	$1.70
1.5	1.16	1.21	1.37	1.73	2.31	2.54
2.0	1.54	1.62	1.70	2.32	3.08	3.40
2.5	1.93	2.02	2.12	2.89	3.86	4.24
3.0	2.32	2.42	2.54	3.46	4.62	5.08
3.5	2.70	2.83	2.97	4.05	5.40	5.94
4.0	3.08	3.24	3.40	4.64	6.16	6.80
5.0	3.86	4.04	4.24	5.78	7.72	8.48

In Bulletin No. 6 findings indicate that "the weighed average incremental electric applicable to cooking for the one hundred largest cities—to be 3.34 cents per hour" whereas for equivalent consumption manufactured gas averaged $1.175 per Mcf., thus establishing that normal electric cooking costs nationally were approximately 2¼ those with manufactured gas. Inspection of the above indicates that juice must get to at least 2.5 cents per Kwh. to be uncomfortable close economically to gas even when distributed under exceptionally adverse circumstances.

In the above it is extremely important to note that comparison is made between new equipment. The distressing element of this competition is that opponents to gas can and do compare new electric ranges to the type of range upon which the customer is then cooking, in the majority of instances a non-insulated and non-heat controlled oven and what is even worse star type burners. Under such circumstances the "break-even" tabulation above must be lowered in price per Mcf. by about 20%. This is the fundamental cause for gas companies scrambling so vigorously to repair their fences by *installing the new* Modern Gas Range *in VOLUME and QUICKLY.*

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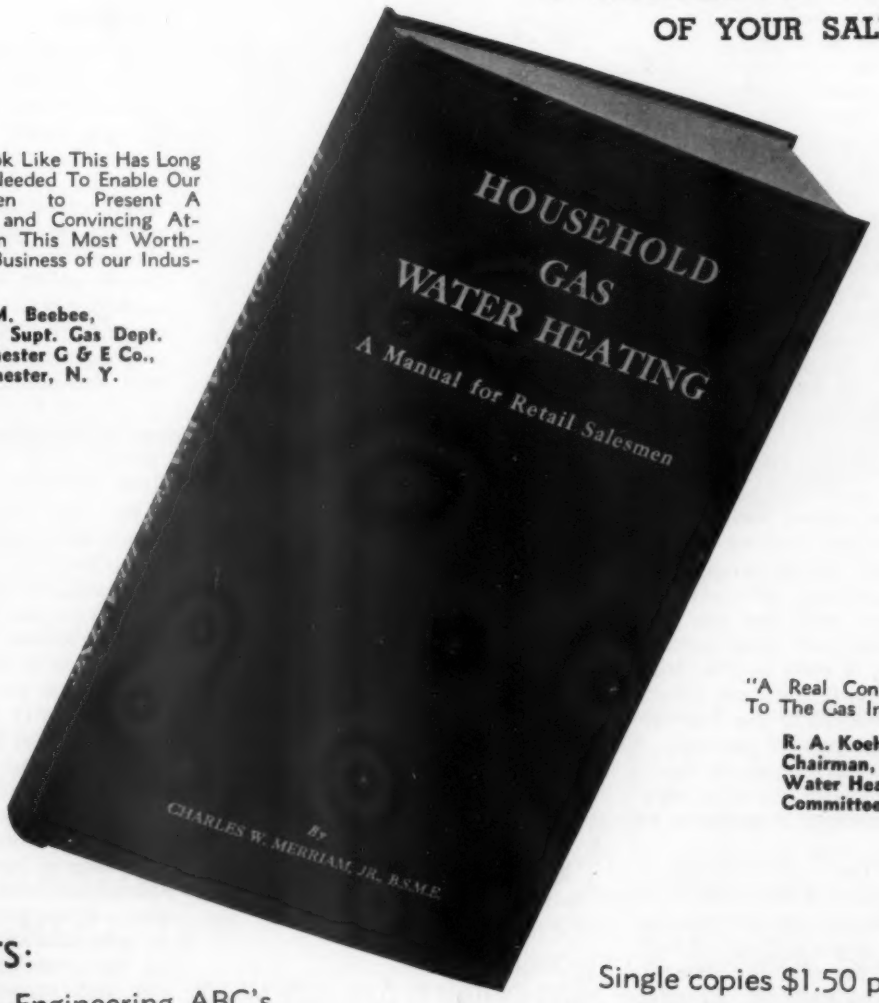

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Burner Arrangements

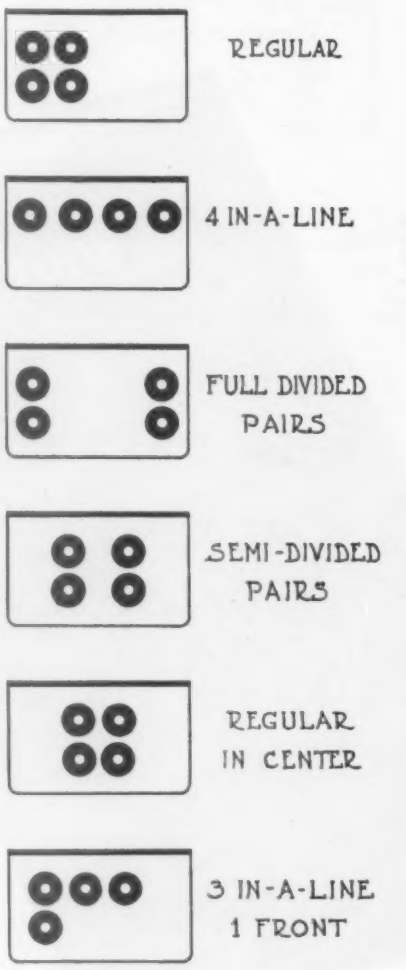
The advent of the table top range offered singular opportunity for the rearrangement of top burners in combinations other than the traditional "four square" at one end. The possible basic burner arrangements are illustrated in the accompanying drawing. Many retailers subscribe to the school of thought which holds that deviation from the customary "regular" (see drawing) introduces possibilities for adding to the utility of a gas range as well as to the customer attention secured by novelty. Nevertheless the observation should be made that when burner cocks remain in their present customary position (that is in front of and just below the top), of the six arrangements shown only the "regular" and "full divided pairs" allow the top of the oven door to fit jam up against the under side of the top plate. This circumstance forces ranges with the other four arrangements of top burners to either the discomfiture of an extremely low broiler and oven or else to the extra expense of a separate elevated broiler. Offsetting this inherent difficulty is the fact that having a separate broiler and oven permits a 4" to 7" air space under the top surface which tends toward a much cooler top working surface.

The "regular" burner arrangement presents a maximum of continuous working space with but one side adjacent to the heat from burners. This grouping is open to the objection that the rear burners are difficult of access, particularly the left rear one for a right handed person. A range with this arrangement should not be installed with a wall or other high vertical surface close up to the left hand side.

The "4-in-a-line" offers the advantages of maximum freedom from heat in getting to all burners and with working space in front of each. By placing in the rear the necessity for a coverall is reduced. Counteracting these improvements is the necessity for two pilots and the fact that with no forward burner the average woman finds it unhandy to prepare cream sauce or other dishes requiring stirring during the process of making. Reversing the "4-in-a-line" by placing the burners in front would sacrifice all top working space.

The "full divided pairs" has a high degree of accessibility and in addition facilitates two people performing simultaneously particularly if there are no cabinets or other obstructions near the ends. By pointing pot handles inward each can be grasped without reaching over a burner. Two ignition pilots are requisite. If coveralls are used, two are required. Working space is flanked on both sides by two burners, a circumstance confining popularity generally to stoves of 39" widths and over.

The "semi-divided pairs" incorporates a fair amount of ease in reaching the burners but segregates



TOP BURNER ARRANGEMENT

the working space into such small areas as to render the same useless from a practical standpoint except as a precarious perch for pans.

The "regular in center" allows working space on both sides but is unhandy as to accessibility of rear burners but not to the extent of the conventional "regular" when such is crowded into a corner. By effectively dividing the working space into halves, neither side is of sufficient size to be of much value, unless area is augmented by a split coverall folded out and extending beyond the ends of the range. This type permits installation with high objects adjacent to either side.

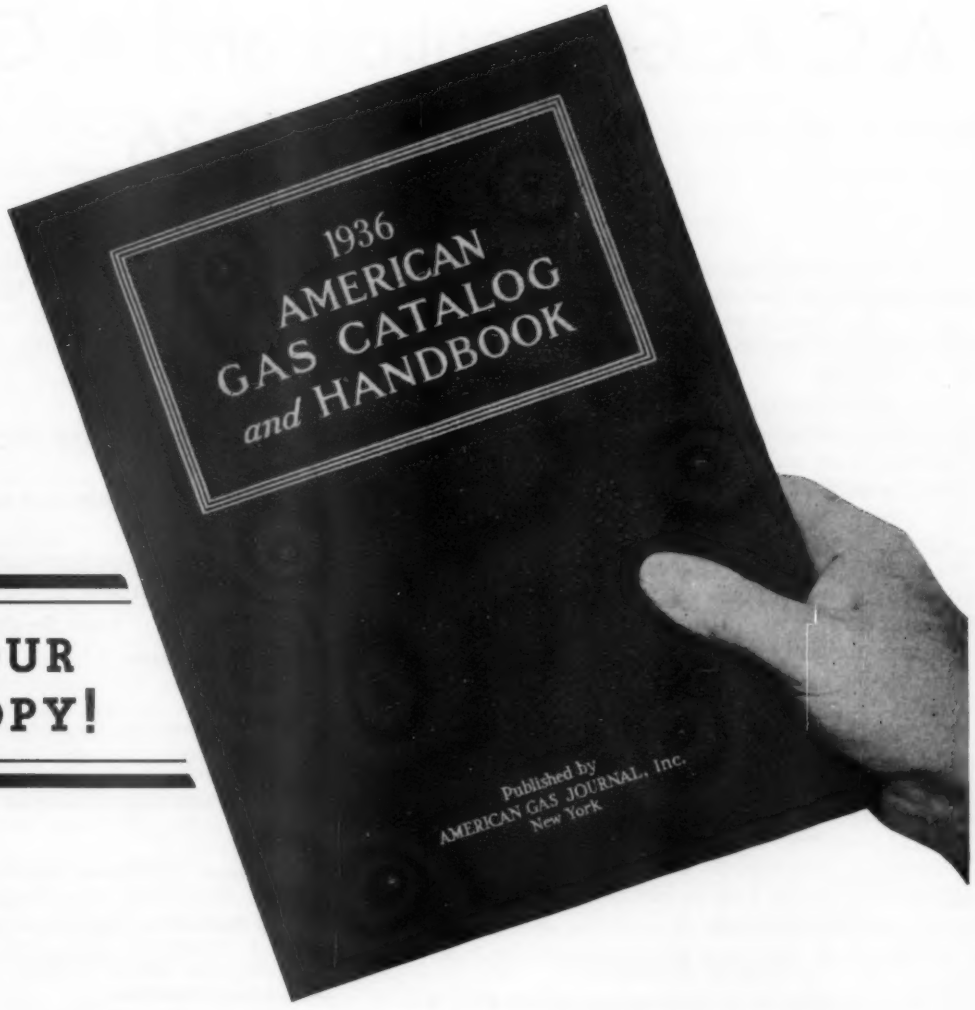
The "3-in-a-line 1 front" (not now manufactured) allows a front burner for operations demanding close attention. Two of the three rear burners have working space in front. All three rear burners can be reached without going over any other. One pilot suffices. Burner arrangement does not restrict range placement in kitchen.

Conclusion

In the March issue with the initial article of this series on ranges, a tabulation was presented evaluating the gas range in comparison with competitive equipment. In this summary of "---the essential considerations respecting fuel choice of domestic cooking equipment---", the classification there asserted that of the 44 points which a rational purchaser should weigh in selecting a range, gas had "A", or top, rating on 36 items, a "B" rating on 7, a "C" on 1 and on "D", none. This series of articles has been devoted largely to fortifying the retail salesman with factual proof in support of each of these rankings.

By any intelligent yardstick by which the relative merits of various fuels for domestic cooking can be measured, the preponderance of logic awards to gas the undisputable first place. Where it is possible for all purchasers to be motivated solely by pure reason gas would be essentially the only entry in the domestic cooking fuel race. But few, if any, selections are made by such a glorious process of thinking—emotion, prejudice, personal persuasion, fretting under the *status quo*, misinformation, pressure of business association, all these and more enter into the equation. Even though the Gas Industry be armed with the irresistible force of the soundest arguments, victory can not rationally be expected in every individual skirmish. But, so long as sober judgment is the criterion upon which basis domestic cooking fuel is selected, gas will continue to dominate the market.

The keystone in the victory arch of the Gas Industry is indubitably the retail salesman. The final battle will be waged on the firing line by the *door bell plugger*. Study, contemplation and discussion develop the quality of resourcefulness, a wholly indispensable part of a salesman's *repertoire*. Dig for the facts. Knowledge is power, power is persuasion, and the power of persuasion is money to the retail salesman.



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AMERICAN GAS JOURNAL
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Please let me know how I can secure a copy of the 1936 Edition of The American Gas Catalog and Handbook.

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A. G. A. Convention and A. G. A. E. M. Exhibit—1936

The Eighteenth Annual Convention of the American Gas Association and the First Exhibit of the Association of Gas Appliance and Equipment Manufacturers will get under way in the Auditorium at Atlantic City, N. J., Oct. 26.

The first General Session will be held Tuesday morning, when in addition to the President's address by Mr. Denning, there will be an address by Dr. John W. Finch, Director of the Bureau of Mines on a subject pertaining to the present and future of natural gas.

On Wednesday morning, Mr. Davis M. DeBard, Vice President of Stone & Webster Service Corporation, will address the second General Session on "Selling Gas—Queen Mary Style." The very important subject of Research and the Gas Industry will be presented at this same session by Mr. Clifford E. Paige, President of The Brooklyn Union Gas Company.

On Thursday, Major T. J. Strickler, Vice President and General Manager of the Kansas City Gas Company, and Chairman of the Committee to Conduct National Advertising, will speak on the subject, "The Public and the Gas Industry." We're all interested in the National Advertising, and Mr. Strickler will have much of significance to say on how to interest the public as well—how to follow through.

Personal Management

This year, for the first time, an opportunity will be provided at an A.G.A. convention for executives concerned with personnel work to meet and discuss their problems. Under the auspices of the Committee on Personnel Practices a luncheon conference will be held at The Shelburne, Atlantic City, N. J., Tuesday, October 27, at 12:30 P.M. Mr. Eric A. Nicol, Chairman of the Committee and Manager of Personnel of The Philadelphia Gas Works Company, will preside at the conference.

Mr. L. A. Appley, Director of Training of the Socony-Vacuum Oil Company, Inc. will be the guest speaker. He has had wide experience and will present an interesting and informative talk on the general subject of training in industry.

Mr. T. H. A. Tiedemann, President, Industrial Relations Counsellors, who has been invited to address the general session of the convention on Wednesday, will probably also speak to the Conference.

Opportunity will be provided for discussion which is planned to be informal and spirited. No record of the proceedings will be kept and members may feel free to enter into discussions without reserve.

Exhibits

The Exhibit will be an item of special interest. During the past two years the manufacturers have been doing outstanding work in research and development of more efficient equipment and appliances. You will see the results of this work in the 150 booths in the Auditorium. The complete list of exhibitors up to time of going to press follows, as well as the the program of the meetings of the sections of the A. G. A.

Tentative Sectional Program

ACCOUNTING SECTION

TUESDAY AFTERNOON
OCTOBER 27—2:00 O'CLOCK
Room D—Auditorium

Address of Chairman
F. L. Griffith, The Peoples Gas Light & Coke Co., Chicago, Ill.

Report of Nominating Committee
A. S. Corson, Chairman, The United Gas Improvement Co., Philadelphia, Pa.

Luncheon Conferences Committee
E. N. Keller, Chairman, Philadelphia Electric Co., Philadelphia, Pa.

Developments in Uniform Classification of Accounts
H. C. Hasbrouck, H. C. Hopson & Co., New York, N. Y.

General Accounting Committee
H. L. Gruehn, Chairman, Consolidated Gas Electric Light & Power Co., Baltimore, Md.

Accounting Regulation
(Speaker to be announced).

Customer Relations Committee
I. K. Peck, Chairman, Binghamton Gas Works, Binghamton, N. Y.

(a) Complaint Causes and Their Correction
P. W. Herring, Chairman, Chicago, Ill.

(b) Ninety Ways to Improve Customer Relations
Louis Stoecker, Chairman, Newark, N. J.

ACCOUNTING SECTION LUNCHEON CONFERENCES
WEDNESDAY AFTERNOON, OCTOBER 28—12:30 O'CLOCK
Ritz Carlton Hotel

The Accounting Section will again have this year the series of Luncheon Conferences which have proved so successful at other Conventions.

Immediately following the Conferences, the attendants will proceed to the Convention Hall and examine the many interesting developments in machine accounting shown at the Exhibit.

Tickets are 1.25 each and will be on sale at the Registration Desk up to 10:30 a.m. Wednesday, October 28.

Luncheon No. 1—Credits and Collections
Mr. G. B. Webber, Presiding, Public Service Electric & Gas Co., Newark, N. J.

Luncheon No. 2—Office Management
Mr. Eric A. Nicol, Presiding, The Philadelphia Gas Works Co., Philadelphia, Pa.

Luncheon No. 3—Customer Accounting
Mr. L. A. Mayo, Presiding, Connecticut Light and Power Co., Hartford, Conn.

Luncheon No. 4—Customer Relations
Mr. T. C. Polk, Presiding, Public Service Co. of Indiana, Indianapolis, Ind.

Luncheon No. 5—General Accounting
Mr. S. J. Barrett, Presiding, The Peoples Gas Light & Coke Co., Chicago, Ill.

THURSDAY AFTERNOON
OCTOBER 29—2:00 O'CLOCK

Room D—Auditorium

Statistics Committee
J. L. Conover, Chairman, Public Service Electric & Gas Co., Newark, N. J.

Accounting Machines Committee
P. J. Sweenie, Chairman, The Peoples Gas Light & Coke Co., Chicago, Ill.

Customer Accounting Committee
R. B. Milne, Chairman, Columbia Gas & Electric Corp., New York, N. Y.

(a) Effect of Recent Economic Conditions on Collection Methods
J. A. Williams, Chairman, Syracuse, N. Y.

(b) Continuous Turn-on and Turn-off Service Order System
R. T. Dudrear, Chairman, Philadelphia, Pa.

(c) Methods of Ascertaining and Maintaining Correct Customer Names
J. W. Mackie, Chairman, Wilmington, Delaware

Office Management Committee
W. N. Geiter, Chairman, Consolidated Edison Co. of New York, New York, N. Y.

(a) Preparation of Correspondence Manuals
J. J. Natale, Chairman, Philadelphia, Pa.

(b) Health Promotion Activities
M. F. Reeder, Chairman, Chicago, Ill.

NATURAL GAS

DEPARTMENT
MONDAY MORNING, OCTOBER 26—10:00 O'CLOCK

Hotel Ambassador

Annual Meeting—Main Technical and Research Committee—Open Meeting
H. C. Cooper, Chairman, Hope Natural Gas Co., Pittsburgh, Pa.

ANNUAL MEETING
MONDAY AFTERNOON, OCTOBER 26—2:00 O'CLOCK

Venetian Room, Hotel Ambassador

Address of Chairman
William Moeller, Jr., Southern California Gas Co., Los Angeles, Cal.

Report of Main Technical and Research Committee
H. C. Cooper, Chairman, Hope Natural Gas Co., Pittsburgh, Pa.

Polymerization of Natural Gas
Dr. J. S. Carey, M. W. Kellogg Co., Jersey City, N. J.

The Trend of Natural Gas in Industry
Frank H. Adams, General Manager, Surface Combustion Corp., Toledo, Ohio

Improving Capacity of Large Transmission Pipeline by Internal Cleaning with Pipeline Scraper
F. J. Trelease, Ford, Bacon & Davis, Inc., New York, N. Y.

Report of Nominating Committee and Election of Officers
J. B. Tonkin, Chairman, Peoples Natural Gas Co., Pittsburgh, Pa.

MONDAY EVENING, OCTOBER 26—6:30 O'CLOCK

Hotel Ambassador

Annual Meeting and Dinner of the Executive, Managing and Advisory Committees, Natural Gas Department

COMMERCIAL

SECTION
TUESDAY AFTERNOON, OCTOBER 27—2:00 O'CLOCK

Room A—Auditorium

Why and How Local Tie-in is Necessary with the National Advertising Program
Henry Obermeyer, Consolidated Edison Co. of New York, New York, N. Y.

Long Term Financing Plans and Results
(Speaker to be announced).

Effect of Promotional Rates on New Business
Hugh Cuthrell, The Brooklyn Union Gas Co., Brooklyn, N. Y.

Appliance Performance Characteristics Demanded by Present Day Competition
(Speaker to be announced).

Bottled Gas—An Ally
H. Emerson Thomas, National Bottled Gas Association, New York, N. Y.

WEDNESDAY AFTERNOON, OCTOBER 28—2:00 O'CLOCK

Room A—Auditorium

Prize Presentations on Range, Water Heater and Refrigerator Contests

THURSDAY AFTERNOON, OCTOBER 29—2:00 O'CLOCK

Room A—Auditorium

Broader Viewpoint of Home Service
E. M. Tharp, Columbia Gas and Electric Corp., Columbus, Ohio.

Refrigeration
(Speaker to be announced).

Campaigning for Water Heating Sales
R. J. Canniff, Pittsburgh Water Heater Co., Pittsburgh, Pa.

House Heating Progress During 1936
B. T. Franck, American Light & Traction Co., Chicago, Ill. and E. H. Lewis, St. Louis County Gas Co., Webster Groves, Mo.

Plans and Methods of Hitting the New Home Market
R. S. Agee, Washington Gas Light Co., Washington, D. C.

HOME SERVICE DIVISION

TUESDAY AFTERNOON, OCTOBER 27—4:00 O'CLOCK

Crane Building, Adjoining Auditorium

Time and Temperature
Jane Roberts, Roberts & Mander Stove Co., Philadelphia, Pa.

Good Home Service Newspaper Copy
Eloise Davison, Herald Tribune Institute, New York, N. Y.

Symposium: Drama in Home Service or What's New

Group of two-minute talks

Small Cooking Schools Designed for Selling
Mrs. Eliza Stephenson, Jersey Central Power & Light Co., Asbury Park, N. J.

Drama Highspots in New Jersey
Mildred Bailey, Public Service Electric & Gas Co., Newark, N. J.

Examinations for Girl Guide Certificates
Helen Bates, Consumers Gas Co. of Toronto, Toronto, Ont., Canada

Radio Ideas for Lecture Demonstrations
Elsie Hinkley, Station WCAU, Philadelphia, Pa.

What Women Readers Ask Us
Ada Bessie Swann, Woman's Home Companion, New York, N. Y.

HOME SERVICE BREAKFAST
WEDNESDAY MORNING, OCTOBER 28—T:30 O'CLOCK

Front Lounge—Hotel Shelburne

(Tickets may be purchased by 5:00 p.m., Tuesday, October 27 at A.G.A. Registration Desk. Tickets $1.25.)

Address of Chairman
Beatrice Cole Wagner, The Philadelphia Gas Works Co., Philadelphia, Pa.

Greetings
L. B. Denning, President, and Alexander Forward, Managing Director, American Gas Association

Impressions of Home Service
Charles E. Bennett, Chairman, Commercial Section

Group of Two-minute Talks

How Home Service Meets Competition
Mrs. Arra Mixter, Hartford Gas Co., Hartford, Conn.

Drama in Cooking Schools
Mrs. Marjorie Wardman, Long Island Lighting Co., Bay Shore, L. I.

Analysis of Home Calls
Ruth Sheldon, Washington Gas Light Co., Washington, D. C.

Kitchen Planning
Frances Leonard, Peoples Water & Gas Co., Miami Beach, Fla.

Classes for Employees
Irene Hickey, Detroit City Gas Co., Detroit, Mich.

INDUSTRIAL GAS SECTION

TUESDAY AFTERNOON, OCTOBER 27—2:00 O'CLOCK

Room B—Auditorium

Address of Chairman
Charles W. Gale, Knoxville Gas Co., Knoxville, Tenn.

Announcement of Convention Features
Ralph L. Manier, Chairman—Program Committee, The Syracuse Lighting Co., Syracuse, N. Y.

Report of Committee on Nominations
J. F. Quinn, Chairman, The Brooklyn Union Gas Co., Brooklyn, N. Y.

Election of Officers

Necessary Sales Activities for a Healthy Growth of Commercial Gas Sales
Roy E. Wright, New England Gas & Electric Association, Cambridge, Mass.

A Recapitulation of the Progress Made in Applying Air Conditioning to Industrial Plants
Charles W. Swenson, Consolidated Edison Co. of New York, New York, N. Y.

Discussion of Above Papers by Members from the Floor

"THE INDUSTRIAL GAS CLUB LUNCHEON"

WEDNESDAY AFTERNOON, OCTOBER 28—12:30 O'CLOCK

Ocean Lounge, Hotel Ambassador

(All delegates to the Convention are invited to attend the Club Luncheon. Tickets are on sale at the Registration Desk and must be purchased before 10:00 a.m., Tuesday, October 27. Price $1.25.)

Presiding
Charles W. Gale, Chairman, Industrial Gas Section

Speaker
Frank C. Smith, President, Houston Natural Gas Co., Houston, Texas

"What Industrial Gas Means to the Balance Sheet"

WEDNESDAY AFTERNOON, OCTOBER 28—2:15 O'CLOCK

Room B—Auditorium

Some Practical Methods of Building and Holding Commercial Cooking Load by the Use of Diversified Appliances
L. R. Foote, Central Illinois Electric & Gas Co., Rockford, Ill.

What the Gas Industry Now Has to Offer in Commercial Cooking Appliances
W. Frank Roberts, Standard Gas Equipment Corp., Baltimore, Md.

Engineering Improvement in Industrial Gas Apparatus and Their Economic Effect
Oliver Lloyd Maddux, United Gas & Fuel Co., Ltd., Hamilton, Ont., Canada

Discussion of Above Papers by Members from the Floor

THURSDAY AFTERNOON, OCTOBER 29—2:00 O'CLOCK

Room B—Auditorium

Today's Methods of Selling Natural Gas to Industrial and Commercial Customers
Edward P. Kramer, Atlanta Gas Light Co., Atlanta, Ga.

What Factors Should Govern the Decision of Gas Companies in Purchasing or Building Industrial Gas Equipment?
Leo Sullivan, Rochester Gas & Electric Corp., Rochester, N. Y.

Combustion Controls for Gas-Fired Boilers—Their Importance to Users and Utilities
L. S. Reagan, Webster Engineering Co., Tulsa, Okla.

Discussion of Above Papers by Members from the Floor

ANNUAL MEETING ASSOCIATION OF GAS APPLIANCE AND EQUIPMENT MANUFACTURERS

SUNDAY AFTERNOON, OCTOBER 25—4:00 O'CLOCK

Rose Room—Hotel Traymore

ADVERTISING

LUNCHEON SYMPOSIUM
PUBLICITY AND ADVERTISING COMMITTEE
THURSDAY AFTERNOON, OCTOBER 29—12:30 O'CLOCK

Venetian Room—Hotel Ambassador

(Tickets must be purchased by 9:00 a.m., Thursday, October 29, at A.G.A. Registration Desk. Tickets $1.25. All delegates to the Convention, all persons interested in the national advertising program, and all members of the Public Utilities Advertising Association are invited to this Symposium.)

Presiding
T. J. Strickler, Chairman, Committee to Conduct National Advertising, Kansas City, Mo.

Speakers
Henry Obermeyer, Chairman, Publicity and Advertising Committee, New York, N. Y.
Donald D. Parry, President, Public Utilities Advertising Association, Hartford, Conn.

Discussion
Full opportunity will be afforded those who desire to present their views on the Association's national advertising program, and ways and means of effective local tie-in with it.

TECHNICAL SECTION

TUESDAY AFTERNOON, OCTOBER 27—2:00 O'CLOCK

Room C—Auditorium

Address of Chairman
F. A. Lydecker, Public Service Electric & Gas Co., Newark, N. J.

Report of Nominating Committee
C. A. Harrison, Chairman, Toledo Edison Co., Toledo, Ohio

Radio Communication to Mobile Units for Normal and Emergency Dispatching in the Operation of Public Utilities
K. Kendall Berlyn, Northern Indiana Power Co., Kokomo, Ind.

The Economics of the Gas Industry
A. M. Beebee and R. E. Ginna, Rochester Gas & Electric Corp., Rochester, N. Y.

Distribution Committee
G. H. Boyd, Chairman, Consolidated Edison Co. of New York, New York, N. Y.

Annual Report to the American Gas Association
Dr. Scott Ewing, A. G. A. Research Associate, National Bureau of Standards, Washington, D. C.

The Syracuse Power Mixer
H. K. Seeley, The Syracuse Lighting Co., Syracuse, N. Y.

THURSDAY AFTERNOON, OCTOBER 29—2:00 O'CLOCK
Room C—Auditorium

Chemical Committee
Louis Shnidman, Chairman, Rochester Gas & Electric Corp., Rochester, N. Y.

Water Conditioning as Applied to Gas Plants
Dr. S. T. Powell, 330 N. Charles St., Baltimore, Md.

The Purification of Commercial Gases at Elevated Temperatures
Prof. Wilbert J. Huff, and Dr. Lloyd Logan, The Johns Hopkins University, Baltimore, Md.

Gas Production Committee
A. E. Lockwood, Chairman, Penn-Western Service Corp., New York, N. Y.

The Economics of Oil Refining by the Gas Industry
D. W. Wilson, The M. W. Kellogg Co., New York, N. Y.

Method of Determining the Relation of Generator Fuel, Oil and Tar in the Evaluation of Heavy Oil for Carburetted Water Gas
H. G. Terzian, United Engineers & Constructors, Inc., Philadelphia, Pa.

Exhibitors

NAME OF EXHIBITOR — **BOOTH NOS.**

A-B Stoves, Inc., Battle Creek, Michigan 413
Gas Ranges

Addressograph-Multigraph Corporation, Cleveland Ohio 700–701
Exhibit will feature latest developments in equipment for mechanical writing of names and data in all departments of public utility organizations and a representative line of equipment for duplicating, general printing and lithography.

Air Reduction Sales Co., New York, N. Y..... 314

The Alpha-Lux Company, Inc., New York, N. Y.... 229
Samples of Gas Purifying Materials.

American Brass Company, The, Waterbury, Conn. 503
A dummy boiler for a gas heating system with hot water low pressure lines of Anaconda tubes, assembled with Anaconda Cast Bronze and wrought solder fittings.

American Cast Iron Pipe Co., Birmingham, Ala.... 705
Models exhibiting the superior physical properties of Mono-Cast (centrifugal) pipe and the Doublex Simplex joint for high pressure gas-samples of Doublex Simplex split sleeves and other service fittings.

American Gas Association Testing Laboratories, Cleveland, Ohio 100
Backwall display with exhibit of scientific instruments and gas appliance testing apparatus.

American Gas Journal, New York, N. Y..... 209
High and low pressure computors and books.

American Gas Products Corp., New York, N. Y.... 405–407
Ideal gas boilers, Redflash convertor, American convertor, A. G. P. Gas fired air conditioner, Regular Chipper and Dictator water heater, Gas fired radiators and Control boards.

American Meter Company, New York, N. Y..... 300–303
A complete line of Tinplate and Ironcase Displacement Meters—Gas and Air Pressure Control Regulators—Indicating, Recording and Integrating Flowmeters—Laboratory Test Meters and Apparatus.

American Stove Company, Cleveland, Ohio 110–114
Domestic and Heavy Duty Magic Chef Gas Ranges.

American Thermometer Co., St. Louis, Mo..... 720

Barber Gas Burner Co., Cleveland, Ohio 232
Barber Automatic Gas Conversion Burners, Burner Units, Gas Pressure Regulators, Safety Pilot Controls, Gas Shut-off Valves and Automatic Control Equipment.

The Bartlett Hayward Co., Baltimore, Md..... 400–401
No Apparatus on Exhibit. Photographs and Catalogs.

Bastian-Morley Co., La Porte, Ind. 614
Premier cabinet heater, Superior sectioned gas water heater, Keystone ditto—Royal Booster as above with storage tank hook-up.—Basmor gas-fired boilers.

G. S. Blodgett Co., Inc., Burlington, Vermont 309
Bake ovens.

The Bristol Company, Waterbury, Conn..... 101
Pyrotrol Automatic Gas Oven Ignition and Protection device. Mercury Contact Thermometer Controllers, Wide-Strip Potentiometer-Type Pyrometers, Portable Recording Pressure Gauges, Fully Compensated Recording Thermometers, Flow Meters, Metameter Systems for Telemetering and Pneumatic Type Controllers.

Bryant Heater Co., Cleveland, Ohio 605–607
Bryant Boilers, Bryant Winter Air Conditioners, Bryant Conversion Burner, Bryant Dehumidifier, Bryant Dualator, Bryant Fire Damper.

Burdett Manufacturing Company, Chicago, Illinois 706
A Radiant Heat Gas Burner ranging in capacity from 15 cu. ft. of gas per hour to 300 cu. ft. of gas per hour.

Burroughs Adding Machine Co., Detroit, Mich..... 523–524
A wide range of machines for customers' accounting and many other applications. A special display of payroll accounting machines. Also, electric carriage typewriters, adding machines, calculators.

Caloric Gas Stove Works, Philadelphia, Penna.... 214
Gas ranges.

Canadian Gas Association & Gas Journal of Canada, Toronto and Hamilton, Ontario, Canada 839
Information bureau covering Canadian gas statistics, gas industry of Canada, Gas Journal of Canada facts and information.

Carson-Cadillac Corporation, Birmingham, Alabama 816
Flexklamp and Carson Mechanical Joints for cast iron pipe and fittings; Repair Sleeves; Charcoal Cast Iron Bolts and Gland Accessories; Carson Bell Joint Leak Clamps and Pipe Couplings.

W. M. Chace Company, Detroit, Michigan 715
A display illustrating thermostatic bimetal elements of various current designs as used in safety devices and temperature indicating and controlling applications.

The Chaplin-Fulton Mf'g. Co., Pittsburgh, Pa..... 307
Pressure Reducing Regulators for Natural and Manufactured Gas for all pressures and services. Many cut-aways of actual regulators with one a working cut-away of the Duplex Sensitive Gas Governor.

Cleveland Gas Meter Co., Cleveland, Ohio 230
Tin Gas Meters—"A" and "B" types. Meters with Direct Reading Indexes. Large capacity meters for house heating. Meters with Bakelite Valves.

Cleveland Heater Co., Cleveland, Ohio 317–318
Regular and advanced models of automatic storage water heaters together with accessories and controls.

The Cleveland Trencher Company, Cleveland, Ohio 133–134
Cleveland Baby Digger, Cleveland Trailer.

Condensation Engineering Corp., Chicago, Ill..... 115
Howle Heat Extractor, Acidulated Vitreous Enamel Condensation Eliminator and Flue Liner.

Connelly Iron Sponge & Governor Co., Chicago, Ill., Elizabeth, N. J..... 231

Iron Sponge, Connelly Oxide, District Governors, Automatic Loaders, Appliance Governors —Service Regulators, Back Pressure and Relief Valves, Caloroptic Btu. Indicator and Alarm System, U. Gauges, nonbreakable type.

Crane Co., Chicago, Ill 612–614
Globe, check, gate, and angle valves of brass, iron, and steel. Screwed, flanged, and welding fittings of forged steel, cast steel, and heavy malleable iron.

Cribben & Sexton Co., Chicago, Ill 416–417
Gas ranges.

Cruse-Kemper Company, Ambler, Pa 206
Pictures of Gas Holders, Condensers, Purifiers, Tanks, Stacks and Flues.

Cutler-Hammer, Inc., Milwaukee, Wis 603
Gas Measuring and Mixing Apparatus. The new Cutler-Hammer Thermeter (with recorder), the Cutler-Hammer Calorimeter with recorder, and an Askania Ratio Regulator, together with auxiliary equipment.

Davey Compressor Co., Euclid, Ohio 726–728

Dearborn Chemical Company, Chicago, Ill 304
NO-OX-ID Rust Preventive, NO-OX-ID-IZED Wrapper, Formula #134 for removal of scale deposits from internal combustion engines, Commercial Powdered Cleaners.

Detroit Lubricator Co., Detroit, Mich 308
Thermotor Throttline Control Gas valve with mechanically operating limit control and Pilot Safety. Solenoid Gas Valves, Room Thermostats, limit controls for steam, hot water and warm air.

Detroit-Michigan Stove Co., Detroit, Mich 420–424
Gas ranges and hotel and restaurant cooking equipment.

Detroit Vapor Stove Co., Detroit, Mich 712–713
Gas ranges.

Dictograph Products Co., Inc., New York, N. Y 626
Dictograph-Telematic Public Utility Customer Control System—provides efficient transmission of necessary information—such as automatic credit approval or rejection, verification of address and meter record—between Customer Records and Service Desks.

S. R. Dresser Mfg. Co., Bradford, Pa 517–519
Dresser Couplings for joining pipe; Dresser Pipe Fittings; Dresser Expansion Joints for absorbing longitudinal pipe movements; Dresser Bell-Joint Clamps for the repair of defective bell joints; Dresser Collar Clamps for the repair of defective screw collars (screw couplings); Dresser Split-Repair Sleeves for the repair of defective pipe and joints by completely enclosing the defective pipe or joints; and various other products for the repair of defective pipe and pipe joints.

Eagle Picher Sales Co 834–835

Eastern Foundry Co., Boyertown, Pa 719
No. 25 Series Peerless super section gas boiler, enclosed trim deluxe model and one Peerless water tube convertible gas boiler.

Economy Governor Co., Anderson, Ind 709
Gas Pressure Regulating Equipment.

Estate Stove Company, Hamilton, Ohio 324–326
Estate Gas Ranges, Estate Gas Heatrola, Estate In-A-Floor Heatrola.

Fisher Governor Co., Marshalltown, Iowa 201
Complete line of Automatic Gas Pressure Regulators for high, low, and intermediate pressures; house service installations; bottle gas and liquefied petroleum gas regulators; butane and propane, air, gas appliances; and low pressure indicating test gauges.

Floyd-Wells Co., Royersford, Pa 710

Forest City Foundries Co., Cleveland, Ohio 207–208
The NIAGARA "220" Gas Furnace. It will be exhibited both in the finished model and in cut-out model. It constitutes a gas fired heating and air conditioning unit for the modern home.

Gas Purifying Materials Co., Inc., Long Island City, New York 619
GPM Iron Hydroxide sponge for gas purification. Portrayal of methods of manufacture.

General Electric Company, Bloomfield, N. J 136–138, 211–213

General Gas Light Company, Kalamazoo, Mich 515–516, 608–609
Humphrey Radiantfires, Humphrey Unit Heaters, Humphrey Gas Lamps, Humphrey Warm Air Units, Humphrey Ambassador Heaters, Humphrey Circulators.

Glenwood Range Co. Taunton, Mass. 507–508
Complete line of gas ranges.

Globe American Corp., Kokomo, Ind. 520–521
Dutch Oven Gas Ranges. Displayed in a reproduction of Colonial Dutch Oven Kitchen.

Handley Brown Heater Co., Jackson, Mich. 310
Mirro-Shell—A new water heating method. "U" tube low input and large demand heaters H-B "Direct-Heat" House Heating Burners.

Hardwick Stove Co., Cleveland, Tenn. 311
Gas Ranges.

Harper-Wyman Manufacturing Company, Chicago, Ill. 618
Harper Speed Simmer Burners, Harper Double Valves, Harper Single Type Burners, Harper Single Valves, Harper Built-In Automatic Lighters.

Homestead Heater Company, Newark, N. J. 121–122
Homestead Woodfires and Coalfires as usual with a showing of two new units in Modern Design that are strikingly interesting.

Hotstream Heater Co., Cleveland, Ohio 221-222
Hotstream Cabinet, Hotstream Tabletop, Utility Special, Hotstream Feature, Dixie, Hotstream Side-Arm, Presteel Heaters (tank) in green and chromium finishes. Tank Heater (Cast Jacket) in Fawn Vitreous Enamel. Heating System with Compression Tank and Controls Complete. Twin 192 Heating System with Thermostat Instantaneous Heater.

Inter Tite Clamp Corp., Elizabeth, N. J. 814

International Business Machines Corp., New York City, N. Y. 600–601
International Electric Bookkeeping and Accounting Machines.

International Nickel Co., New York, N. Y. 110–112

Johns-Manville, New York, N. Y. 837

Koppers Construction Co., Pittsburgh, Pa 400–401

Lambert Meter Co. Inc., Brooklyn, N. Y. 305
Gas Meters, Diaphragms, Meter Repairing, Provers Service Cleaners, Wet Test Meters, Demonstration Meters, Portable Test Meters, Siphon Gauges, Calorimeters, Indicating Flowmeters, Recording Flowmeters, Demand Meters.

Lattimer Stevens Co., Columbus, O. 203

E. J. Lavino and Company, Philadelphia, Pa 611
Lavino Activated Oxide. A manufactured material made expressly for the purification of gas. Manufactured under U. S. Patents.

Lovekin Water Heater Co., Philadelphia, Pa. 227
Lovekin Automatic Gas Water Heaters, Standard storage heaters in various tank capacities. Multitube Storage Heaters with automatic secondary air damper control.

Lux Clock Company, Waterbury, Conn. 217
MINUTE MINDERS—short period alarms designed to correctly time cooking operations; eliminating the necessity of watching a clock.

McWane Cast Iron Pipe Co., Birmingham, Ala. 210
1¼", 2" cast iron threaded and mechanical gas joint pipe. 4" and 6" Boltite mechanical, rubber ring, gas joint pipe. Bell and spigot cast iron pipe and fittings.

Mercoid Corporation, Chicago, Ill. 724
Complete line of automatic controls for gas burning equipment, including the Powerstat, the Sensatherm, magnetic gas valves, double adjection controls for temperature and pressure.

Merco Nordstrom Valve Co., Pittsburgh, Pa. and Oakland, Calif. 522–602
Nordstrom, Emco Nordstrom and "Hypreseal" Lubricated Plug Valves. Nordstrom Service Cocks, Meter Cocks, Air Cocks.

Milwaukee Gas Specialty Co., Milwaukee, Wis. 408
Gas Cocks, Lighters, Thermo-Electric Switch, Baltimore Automatic Shut-Off.

Mine Safety Appliances Company, Pittsburgh, Pa. . 725
MSA Hose Masks, Self-Contained Oxygen Breathing Apparatus, Canister Type Gas Masks with Carbon Monoxide Protection, Comfo Respirators, Edison Electric Cap and Hand Lamps, H-H Inhalator, First-Aid Materials and Kits, Safety Clothing, Skullgard Protective Hats, Combustible Gas Indicator, Combustible Gas Alarm, bustible Gas Indicator, Combustible Gas Alarm.

Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. 403–404
The exhibit will have the new Colorama lighting as a background in its exhibit, which is finished in pure white.
The effect of this lighting is that of a constantly changing soft light in a variety of shades providing an unusual and pleasing backdrop for the complete line of thermostats, gas valves, automatic pilots, and other controls for all types of gas fired units which will be on exhibit.

Monroe Calculating Machine Co., Minneapolis, Minn. 734

Morse, Lockhart & Morse, Inc., Boston, Mass. 828
Complete line of locking devices for the prevention of gas theft: #4 Lock, Lock Cap, Lock Plug, Meter Union Clamps, Cock Clamp, Meter Union Seals, Wing Cock Protectors; Firomatic Swivel and Insert Valves for the prevention of loss by fire.

Mueller Co., Decatur, Ill. 320
High pressure line stopping and plugging units, pressure control fittings for by-passing gas in distribution and transmission lines, drilling machines, tapping machines, gas regulators, stop meter hangers and relief valves.

L. J. Mueller Furnace Co., Milwaukee, Wis. 225–226
Gas-fired furnaces and boilers—Mueller Climator Air Conditioning Units—Muelleraire Unit Heater.

Mulcare Engineering Co., Inc., New York, N. Y. .. 709
Gas Distribution Equipment. Economy Governors, Gasco Gauges, Gasco Filtgovs.

The National Cash Register Co., Dayton, Ohio 732–733
Billing machines with 21 individual acculators or 42 split accumulations and making a 4-part bill. Other models with various numbers of accumulators. Typewriter bookkeeping machine.

National Lock Co., Rockford, Ill. 838
Molded Plastic and Chromium Oven Door and Gas Cock Handles, Bakelite Knobs, Continuous Hinges, Butts and Hinges, Stove Bolts.

National Machine Works, Chicago, Ill. 722
Lo-Blast Power Type Gas Conversion Burners in five sizes—Numbers 1 to 5 inclusive. Capacities ranging from 100,000 Btu per hour to 2,000,000 Btu. per hour. In addition a Number 2 Burner firing into an open combustion chamber will be exhibited.

National Radiator Corporation, Johnstown, Pa. .. 102–103
National Gas Heating Boiler, National Air Conditioning, National Art Radiator, National Aero Convector.

National-Superior Co., Dayton, Ohio 228
Exhibit includes Couplings No. 1, No. 4,—4A, Boltless; Sleeves, No. 5, 8½ split; Clamps, No. 15 Band, No. 9 Collar Leak, 12B Bell Joint, Combination Fittings; National Swaged Nipples and Bull Plugs.

Norge Div., Borg-Warner Corp., Detroit, Mich. 712–713
Gas-fired Fine Air Conditioning Furnace, Gas Ranges.

Patrol Valve Co., Cleveland, O. 315–316
New safety devices for ranges, water heaters and major appliances. Relief valves, thermostatic controls, pilot safety and oven ignition equipment.

Peerless Mfg. Corp., Louisville, Ky. 224
Hearth-Fyre Heaters and New Type Conversion Burner.

Pennslyvania Furnace & Iron Co., Warren, Pa., ... 223
Pennco Deluxe Air Conditioning Furnace; Pennco Gas Boiler, Deluxe, 3″ Series; Pennco Gas Boiler, Deluxe, 2″ Series.

Pittsburgh Coal Company, Pittsburgh, Penna. 625
We will illustrate by model, photographs and paintings the practices employed in the mining and preparation of Champion Coal and the relation of the mining industry to general industry.

Pittsburgh Equitable Meter Co., Pittsburgh, Penna. 522–602
Gas Meters, Gas Pressure Regulators and Allied Accessories. In booths 703-704 will be a special showing of the EMCO Rangelator, a new pressure control for gas ranges, water heaters, small space heaters and similar appliances.

Pittsburgh Equitable Meter Co., Pittsburgh, Penna. 703–704
The EMCO "Rangelator"—A pressure control for use on gas ranges, water heaters, small space heaters and similar appliances.

Pittsburgh Water Heater Co., Pittsburgh, Pa. 312–313
New models M 1 and M 2 gas fired water heaters.

Radiant Equipment Corp., New York, N. Y. 714

Remington Rand Inc., Buffalo, N. Y. 627–628
Initial showing Multiple Print Billing Machine. Customer History Record. Sales Control Systems. Stores Control Systems. Meter Reading Equipment and Methods. Security Deposit Record System. Delinquent Notice Forms and Procedure. Application and Service Order Systems. Latest filing equipment and methods. Photography of business record.

Republic Steel Corporation, Cleveland, Ohio 36
An interesting display of steel products manufactured for the Gas Industry, also a group of finished articles manufactured from Republic products. Featured will be electric weld pipe, Toncan Iron pipe, steel and copper bearing pipe, Enduro Stainless Steel, Toncan Iron Enameling Stock, Toncan Iron Sheets, Republic Galvannealed, Upson bolts and nuts, Electrunite Stainless tubing.

Reynolds Gas Regulator Co., Anderson, Ind. 327–328
Gas Pressure Regulators (Service Regulators both high and low pressure, Pounds-to-pounds Regulator, Pounds-to-inches Regulators, Toggle-Type Regulators, Working Models, Sectional Views.)

The Ridge Tool Company, Elyria, Ohio 815
Wrenches (Ridgids), Die Stocks (Threaders), Pipe Cutters and Tubing Cutters, Vises, Cutting Oil, Improved Stillson Wrenches, Ridgid Longrip Screw & Pipe Extractors, Ridgid Service-Box Cover-Screw.

Roberts Brass Mfg. Co., Detroit, Mich. 610
A full line of Gas Cocks, Brass Fittings and Special Parts for all types of gas appliances.

Robbins Publishing Co., New York, N. Y. 200

Roberts Gordon Appliance Co., Buffalo, N. Y. 719
Gas conversion burners for various shaped furnaces and boilers. Industrial unit gas burner, Peerless gas fired boiler, Peerless converto gas burner.

Roberts & Mander Stove So., Phila, Pa. .....418, 419—505
Gas Ranges.

Robertshaw Thermostat Co., Youngwood, Pa. 504
Thermostats, Temperature Controllers, Safety Pilots, Automatic Lighters.

Roots-Connersville Blower Corp., Connersville, Ind. 202
Industrial gas meters of different sizes with various types of registering and indicating instruments.

Geo. D. Roper Corp., Rockford, Ill. 415–509
DeLuxe six burner High Broiler Table Top; Standard 4 burner Table Top; Tubelar Model with stool.

Ruud Manufacturing Co., Pittsburgh, Pa. 410-412
A complete line of automatic and non-automatic gas-fired water heaters.
Two general classes of automatic water heaters will be shown—storage and faucet-action. In the first group will be full-speed and customer control models; in the second, continuous flow, Model W and sink water heaters. In the non-automatic class, pressed-steel tank water heaters and the Acme Combination Water Heater will be exhibited.

Safety Gas Main Stopper Co., Brooklyn, N. Y. 108
Street Department Supplies.

W. J. Schoenberger Company, Cleveland, Ohio 414
Gas valves and fittings for ranges, space heaters, water heaters, boilers and furnaces—and also valves and fittings for heavy duty and commercial appliances.

Semet-Solvay Engineering Corp., New York, N. Y. 707
The New Semet-Solvay Reverse Flow Water Gas Machine; The New Semet-Solvay Waste Heat Boiler; Semet-Solvay equipment for manufacture of coal gas, water gas, producer gas, blue gas. Scrubbing, condensing and purifying equipment; welded steel piping and valves.

Servel, Inc., Evansville, Ind. ..... Stage
Electrolux gas fired refrigerators.

Silex Company, Hartford, Conn. 135

M. B. Skinner Co., South Bend, Ind. 233
Skinner M-32 Bell Joint Clamp, Skinner Split Coupling Clamp, Skinner Service Saddle, Skinner Pipe Joint Clamp, Emergency Pipe Clamp, Skinner Pressed Steel Economy Clamp, Skinner.

A. P. Smith Mfg. Co., East Orange, N. J. 149
Tapping Machine, Air Motor Operated, for use in making connections to gas mains under pressure. Tapping Sleeve and Valve which is used with the above machine, this machine showing how 4" connection can be made to 6" gas main—and the Sleeve fitted with Dresser Couplings. 8" Lubricated Seat Valve.

Spencer Thermostat Company, Attleboro, Mass. ... 723
Will include typical examples and working models of control systems which may be worked out with Klixon controls, both all gas-actuated and electric for gas space heating appliances, diaphragm valves, automatic pilot valves and switches, and gas-actuated and electric room thermostats.

The Sprague Meter Company, Bridgeport, Conn. .. 319–409
Full line of domestic and industrial meters and regulators for high and low pressure service. A special feature will be made of our industrial line of meters, as well as our "Streamline" type of high pressure regulators. A full line of tools for maintenance work and a number of improved features for our standard lines of both meters and regulators will be shown.

Standard Gas Equipment Corporation, New York, N. Y. 321–323
New line of Vulcan Deep Fat Fryers with insulated combustion chamber and immersed flues; Ceramic Broiler, Vulcan Radial Fin Top range; Gas burning kitchen heater domestic range; new line of domestic ranges with streamline base and chromium handles with enamel inlay. Also a new line of Smoothtop gas ranges with enamel top. Special Radio City exhibit.

Superior Meter Company, Brooklyn, N. Y. 234
Tin Gas Meters—All Sizes. Demonstration Meter, Portable Test Meter, Service Cleaner, Prover, Diaphragms.

Surface Combustion Corporation, Toledo, Ohio 500–502
Janitrol Conditioners, Janitrol Conversion Burners, Janitrol Unit Heaters, Thrift Water Heaters, Small Industrial Burners.

Tappan Stove Company, Mansfield, Ohio 623–624
Full line of new Tappan models DeLuxe and Standard No. 11 Series. Ranges will be shown in modern kitchen settings.

Therminsul Corporation, Kalamazoo, Mich. 216
Complete line of rock wool products suitable for insulation used in gas and electric ranges, gas heated hot water tanks, jacketed gas fired boilers, ovens and incinerators. Display models of gas range manufacturers will be shown exhibiting correct installation methods of insulation.

Time-O-Lite Controls Corp., Milwaukee, Wis. 716
Remote control equipment for Tank Water Heaters, Time and Manual, House heating control equipment, snap and modulating, Industrial Control.

Tinnerman Stove & Range Co., Cleveland, Ohio .. 506
Tinnerman Streamline Gas Ranges, Tinnerman "Speed Nuts."

Titan Valve & Mfg. Co., Cleveland, Ohio 718
Titan Snap Action Thermostats, Pressure and Temp Relief Valves, Safety Pilots, Safetystats, Mancostats, Nu-Drain.

United American Bosch Corp., Springfield, Mass. .. 120
American Bosch Ball Tank Storage Heater. Kabinette Storage Water Heater. American Bosch no tank instantaneous Water Heater.

United Engineers & Constructors Inc., Philadelphia, Penna. 604
Carburetted Water Gas and Coal Gas Plants; U. G. I. Heavy Oil Process; U. G. I. Reforming Process for Refinery Oil Gas and Natural Gas; Scroll Tar Separator; Mechanical Generator; Pipe Line, Gas Main and Gas Distribution Construction.

United States Pipe & Fdy. Co., Burlington, N. J. .. 402
Super-deLavaud Pipe and Fittings for Gas Demonstration of the Ductility of Super-deLavaud Cast Iron.

United States Steel Corporation, Pittsburgh, Penna. 830–832
Various types of pipe for gas distribution including mains, laterals and service lines. The principal feature will be a seamless pipe of large diameter and unusual length. Other pipes on display will be electric weld, scale free, copper-steel and duroline pipe. Various types of coating will be shown including galvanizing, dips, and fabric-wrapped national coating, both single and double ply.

Utilities Publication Committee 204

Wailes Dove-Hermiston Corp., New York, N. Y. .. 721
Materials for the protection of pipe against corrosion.

Waukesha Motor Company, Waukesha, Wis. 836
Waukesha Ice Engine (commercial type) condensing unit, Waukesha Evaporative type Condenser, Waukesha Ice Engine (Railway type) Condensing unit, Waukesha DeLuxe power unit.

Harry C. Weiskittel Co., Inc., Baltimore, Md. 215
Gas gauges, two burner hot plates.

Welbilt Stove Co., Maspeth, N. Y. 218–220
Gas ranges.

Welsbach Co., Gloucester City, N. J. 113–114
Hotzone Automatic Storage Gas Water Heater, Conversion Gas Water Heater, Furnace Conversion Burner, E-Z Lite Range Conversion Burner, Hotzone Broiler Griddle, Space Heater.

Western Business Papers, Los Angeles, Calif 717

Whitehead Metal Products Co., New York, N. Y. 110–112

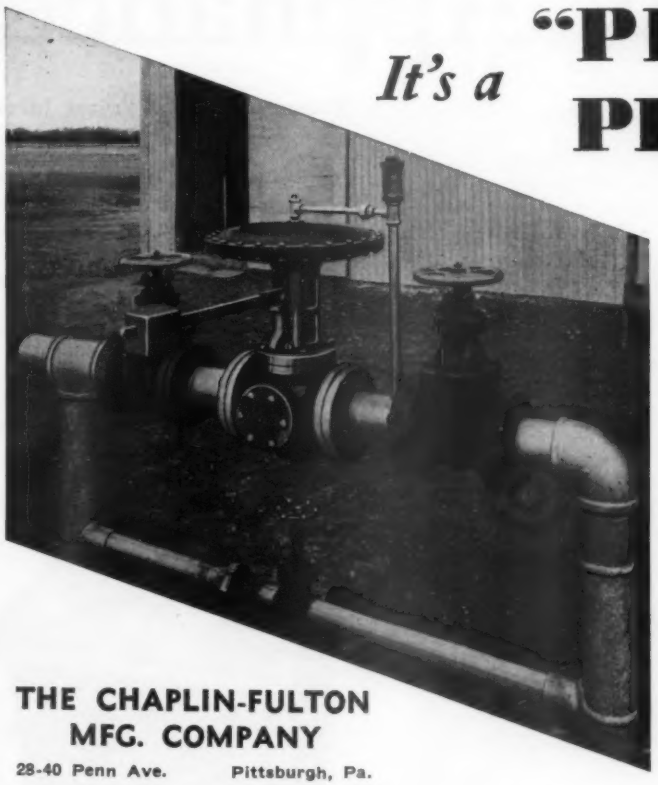
Wilcolator Company, Newark, N. J. 306
Temperature controls for all types of gas appliances, including ranges, heaters and water heaters.

H. A. Wilson Co., Newark, N. J. 617
Wilco Thermometal (Thermostatic Bi-metal) strips and formed pieces including coils, helices and spirals. Wilco electrical contact points of silver, platinum, platinum iridium special alloys and steel back contacts.

R. D. Wood Co., Philadelphia, Penna. 622
Cast Iron Pipe and Fittings. Oval Seal Mechanical Joint Pipe and Fittings.

John Wood Mfg. Co., Conshohocken, Pa. 615–616
Full line domestic gas water heaters.

Youngstown Sheet & Tube Co., Youngstown, O. .. 119



It's a **"PRESSURE-PROTECTOR"**

CF

All you do is determine the desired pressure of your gas line, and set the weight on the lever of a Chaplin-Fulton Regulator at the proper position. Low or high, that exact pressure will be maintained. Nothing short of an earthquake can change it.

There are many types of Chaplin-Fulton Regulators, including the *Low Pressure Regulator* with an automatic cut-off, as shown. They have covered all requirements of pressure control for over 50 years.

THE CHAPLIN-FULTON MFG. COMPANY
28-40 Penn Ave. Pittsburgh, Pa.

BE SURE TO VISIT THE

CONNELLY

BOOTH NUMBER 321

A cordial invitation is extended to all gas men to pay us a visit in Atlantic City. We are sure that those who stop in will be interested in the latest developments in CONNELLY APPARATUS AND EQUIPMENT. Manufactured gas men will also be interested in the most recent facts regarding GAS PURIFICATION.

CONNELLY IRON SPONGE & GOVERNOR CO.

3154 S. California Ave.
Chicago, Ill.

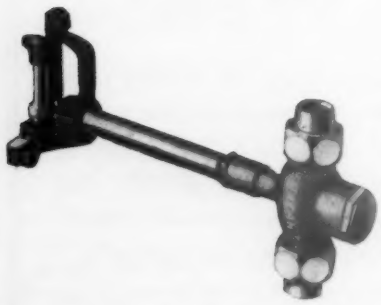
200 S. Second St.
Elizabeth, N. J.

New England Agent: T. H. Piser, Wellesley Hills, Mass.

New Appliances

Safety Pilot for Hot Water Heaters

The illustration shows a Titan Safety Pilot for domestic hot water heaters. It is a simple, rugged instrument, operated by the small, constant pilot flame, which ignites the burner whenever gas is supplied to it.

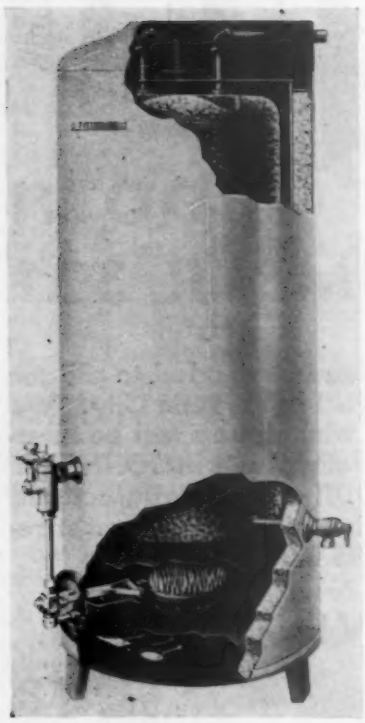


The operating element consists of a bimetal strip in contact with the pilot flame. As long as this pilot flame remains lighted, the bimetal strip remains bent, and its free end holds a rod against the ball valve, thereby allowing the gas to flow to the burner.

If the pilot flame becomes extinguished at any time, the bimetal strip immediately begins to cool and straighten. Within a very short period of time, the strip returns to its normal straight position, drawing with it the rod, thereby allowing the ball valve to return to its closed position against the valve seat. In this position the valve prevents gas from flowing to the burner.

The Safety Pilot is set according to the safety requirements of the American Gas Association and has *full* A. G. A. approval and is manufactured by the Titan Valve & Manufacturing Co., Cleveland, O.

Pittsburg Features A Popular Price Leader in Streamline Water Heaters



Pittsburg Model M-1

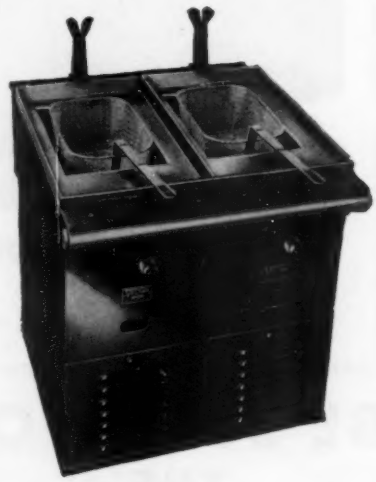
When the Pittsburg Water Heater Corporation took several strides ahead and designed streamline models to meet the popular demand for modernism in domestic equipment, it was discovered that by virtue of streamlining new engineering advancements could be made and also that it would be possible to produce a leader model to sell at a very attractive popular price.

This particular model, the M-1, is a fast recovery storage heater with capacities from 20 to 40 gallons and a recovery rate of from 28 to 56 gallons per hour.

It has Pittsburg's exclusive rust proofing treatment, Bonderizing of all formed steel parts, extra heavy insulation, such safety devices as pressure relief valve integral with the drain valve and automatic pilot light control with dual safety action. The high speed burner operates on the "Airated" principle, controlling and directing the air mixed with the burning gas, which tends to speed up heating and conserves gas. Water temperature is automatically maintained by means of a thermostatic control which can be set as desired.

Vulcan Deep Fat Fryers Incorporate New Features

A new deep fat fryer has just been announced by the Standard Gas Equipment Corporation, New York. The fryer has a new type kettle. Intense heat is generated in an insulated combustion chamber by a highly efficient burner. The flames, however, do not pass into the flues, which are immersed in the fat, and as the



Double Unit Deep Fat Fryer

fat does not come into contact with flame-heated surfaces, there is no carbonizing of food particles and consequently no black specks.

As the heat-transmitting immersed flues have a large area (600 to 1000 square inches), more effective use is made of the heat with resultant economy in gas. Further, fat is said to be heated faster and fat temperature recovery quicker, speeding up service and assuring better quality fried foods.

A special Robertshaw heat control and snap-action valve automatically maintains any fat temperature desired.

Other features incorporated in the new fryer are: thick rock wool insulation; ample sediment space in the cold zone; quick-action drain valve and a special non-splash drain pan; high rim on kettle, which prevents fat from boiling over when cold food is put in; a manifold shield and safety gas cock.

and Equipment

New Round Burner Models

The Barber Gas Burner Company, Cleveland, Ohio, has just placed on the market new conversion burner models for use in round furnaces or boilers having grates up to and including 20 inches in diameter. Among the many improvements embodied in these new designs are higher heating efficiency and greater ease of installation. Special features of construction enable these burners to be correctly installed in the least possible time. Deflection of heat to the sidewalls is accomplished by a semi-steel deflector with deflector ring, which produces a scrubbing action of the flame on the side-walls, which makes for maximum efficiency as well as economy. These burners require no refractory elements, saving installation time and replacement.

The burner unit shown herewith is a close-up of Barber Burner Unit No. X44, and includes this Unit with all necessary equipment for full automatic control. These new burners are also furnished for manual control.

Noted Designer Creates Streamline Style for Niagara Units

When the newly styled Niagara Two-twenty air conditioning unit, gas fired, was previewed by a small, select group at a special exhibit just held in Cleveland, it became immediately evident that Wilbur Henry Adams, noted stylist of household appliances had scored another outstanding success.

With the exception of its exterior, the Niagara Two-twenty is the same unit that has certain exclusive features, among which are: a central combustion chamber providing a means for regulating and proportioning the amount of gas consumed to the requirements of the home; a thermo-syphon and counterflow system of heat extraction and distribution which transfers a greater volume of heat to warm circulating air; a twin blower, with no bothersome belt, but driven directly by a quiet motor which automatically switches itself between high speed, low-speed or shut-off, depending upon the room thermostat's demand.

This newly styled Niagara Two-twenty marks a long step forward in the beautification of gas fired air conditioning equipment for the modern home. It is manufactured by The Forest City Foundries Company, Cleveland, Ohio.

New Bulletin on Industrial Meters

Sprague Meter Company, Bridgeport, Conn., has issued bulletin No. 19 covering the Sprague line of Industrial Meters. The Bulletin is replete with illustrations and drawings of the various assembly units with a complete list of parts. These meters handle working pressures up to 75 lbs. per square inch. All bearings are self lubricating. The handholes on each side of the meter through which the crank and speed adjustments are made are large enough to admit the hand for ease of adjustment and to obviate the necessity of removing the top casting.

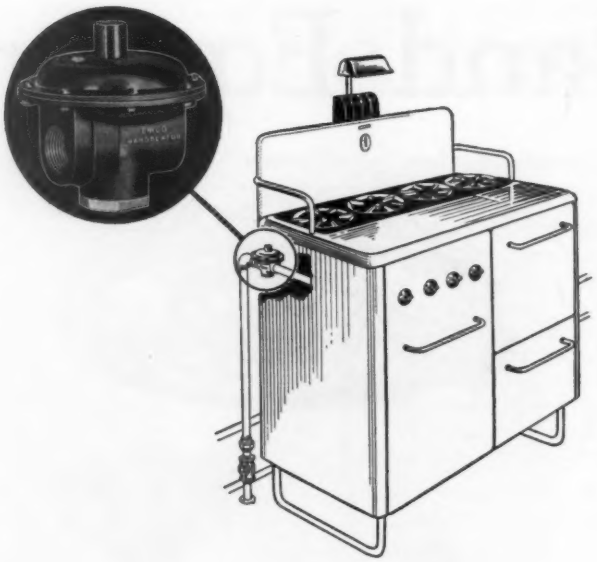
Sprague Industrial Meter

The Emco "Rangelator"

A new pressure control regulator, known as the "Rangelator" especially designed for controlling burner pressure on gas ranges, small space heaters, water heaters and similar appliances.

The "Rangelator" is described as being particularly suited to overcome range burner difficulties such as pilot lights either going out entirely or burning too high, simmer burners operating at improper input, and the by-pass supplying too much or too little gas after the oven thermostat has cut off the main supply. The manufacturers claim that with this device installed on a range all burners, including pilot lights, can be set to operate at their highest effficiency, regardless of fluctuations in line pressure.

For further information write the Pittsburgh Equitable Meter Company, 400 N. Lexington Street, Pittsburgh, Pa., for bulletin No. 1032.



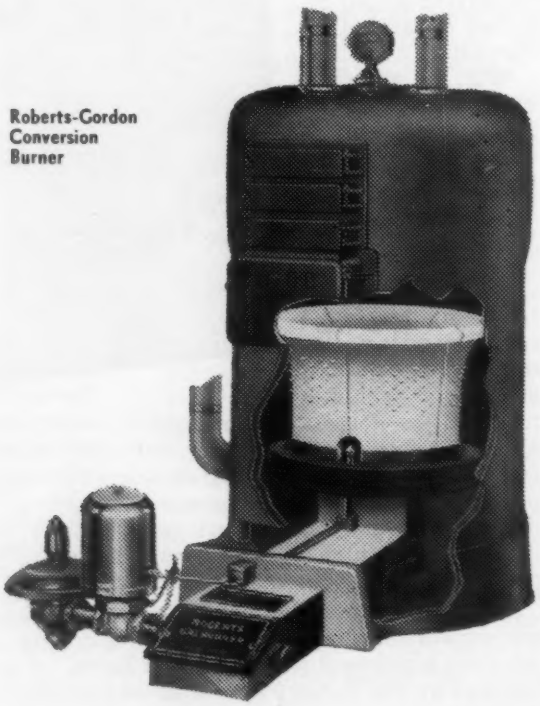
Hotstream "Tabletop" Water Heater

The Hotstream "Tabletop" Automatic Storage Water Heater is not only a water heater, but placed in the kitchen, becomes a "handy-aid" to the housewife. It is built table-high and has a strong porcelain enamel top which makes it a utility table. It is fully equipped with safety pilot, throttling adjustment valve, thermostat, filtrap, temperature and pressure relief valve and the finish is white enamel with black base. Manufactured by Hotstream Heater Co., Cleveland, O.

Suggestions for Building Gas Load

Above is title of a comprehensive catalog recently issued by Roberts-Gordon Appliance Corp., Buffalo, N. Y. The catalog does not contain sample advertisements, but a large number of reproductions of photographs and drawings, which can be used in the preparation of advertising copy or booklets by gas companies who sell the Roberts-Gordon Conversion Burners. Illustrations are shown of all types of gas boilers and hot air furnaces in which their equipment can be installed.

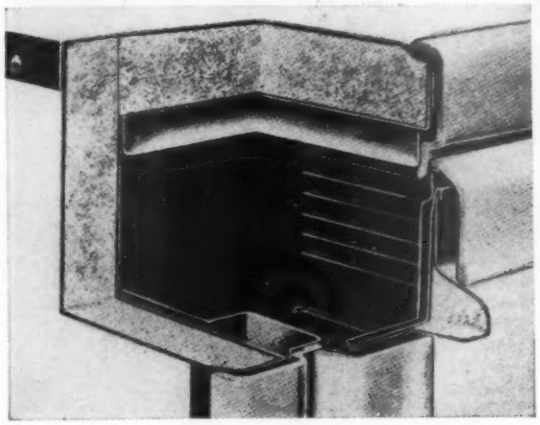
There are several comic strips for use in promoting gas househeating. Samples of a large number of mailing pieces, printed in colors, are included.



Roberts-Gordon Conversion Burner

PERMANENT THERMINSUL INSULATION

PERMANENT INSULATION



Every Block of Therminsul is cut to exact dimension and fits snugly into place. No joint leakage.

FOR COMPLETE INFORMATION
VISIT OUR ATLANTIC CITY

BOOTH
No. 216

Do The Ranges You Sell Have It?

Insulated ranges, if they are to live up to the buyers' expectations, must be permanently insulated. There is just one answer to this important problem—THERMINSUL FELTED ROCK WOOL BLOCKS.

THERMINSUL blocks are a homogeneous uniform block of higher efficiency than raw wool. Every block is cut to exact dimensions, thus speeding assembly work. The fibers of adjoining blocks intermingle giving perfect insulation at the joints without cement. Surfaces of the blocks are crusted which assures against sifting of material to the floors of display rooms or kitchens. Therminsul is proof against vermin and disintegration. Its resiliency compensates for expansion and contraction. Produced in specially designed machines and under close technical control, THERMINSUL is reliable and inexpensive.

THERMINSUL is also an excellent insulating material for boilers, water heaters, incinerators and other heating equipment.

The Therminsul Corp.

of America

1603 Fulford St., Kalamazoo, Michigan

THE GOODMAN STOPPER

GOODMAN — USED SINCE 1897 — 2" HANDLE & LOCKING SLEEVE — GAS MAIN STOPPER

The Reliable Shut-Off for Street Mains

Equipped with Improved Patented Locking Sleeve, which locks both handles to the pipe. Stopper cannot slip. Gas cannot pass.

Safety Gas Main Stopper Co.

523 Atlantic Avenue, Brooklyn, New York

MODERNIZE WITH MOHAWK PRODUCTS

ALL STEEL
MOHAWK HI-SPEED TRAILER
TOOL AND SUPPLY TRAILERS FOR GAS AND ELECTRIC COMPANIES
HOTSTUF BITUMEN HEATERS
LEAD AND COMPOUND MELTING POTS
Hotstuf

MOHAWK ASPHALT HEATER CO. 26 WEAVER ST. SCHENECTADY, NEW YORK 100 PARK PLACE, NEW YORK, NEW YORK

HOUSEHOLD GAS WATER HEATING

By Chas. W. Merriam, Jr.

PRICE $1.50 EACH

ISBELL-PORTER COMPANY

Engineers and Contractors for Complete Gas Works

I-P C

Manufacturers of All Kinds of Gas Apparatus

NEWARK, NEW JERSEY

News of the Industry

World Power Delegates Study American Gas Practice in Cleveland

Pre-Conference Tour Groups Attracted by American Gas Association Testing Laboratories

Official governmental delegates and power luminaries from 10 leading countries of the world were introduced to the American Gas Industry on August 31 and September 2 when Pre-Conference Tours of the Third World Power Conference, Washington, D. C., visited Cleveland, Ohio, and inspected the East Ohio Gas Company's facilities and the American Gas Association Testing Laboratories. Of 49 distinguished foreign visitors to Cleveland's utility and industrial organizations, 15 elected to devote approximately half of their crowded time in Cleveland to the Laboratories and to learning first hand of this country's national program of gas appliance testing, certification and research.

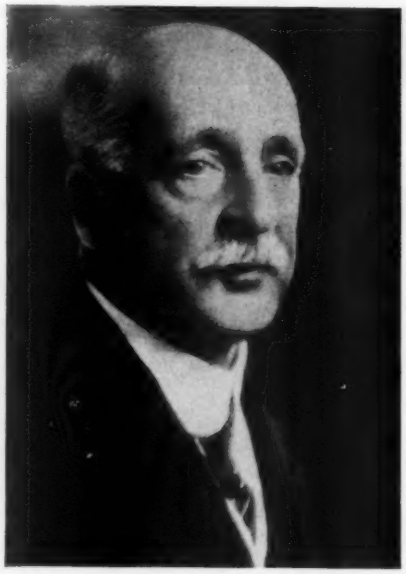
Forming in effect an "itinerant League of Nations in the power field" the group included such outstanding figures as the following who selected the gas laboratories visit from four offered tours:

Commander Ryaichiro Enomoto, Imperial Japanese Navy, Tokyo, Japan; Olaf Engbo, eminent consulting engineer, Copenhagen, Denmark; J. Henry Scattergood, Treasurer, Bryn Mawr and Haverford Colleges, Philadelphia, Pennsylvania, U.S.A.; Wm. Alexander Lee and wife, Secretary, Mining Association of Great Britain, London, England; C. C. Hsiao, Technical Expert, National Geological Survey of China; Arnaldo Pacanins, Ministry of Promotions, Venezuela; Madame G. E. Lemaitre, wife of utility magnate of Geneva, Switzerland, and Paris, France; Frau Laszlo de Verebely, wife of Professor de Verebely, of the Royal Hungarian Technical University, Budapest, Hungary; Councillor James Kerfoot, Fellow of the Royal Textile Institute and Expert on Sewage Disposal, Manchester Authority, London, England; Edwin Hanson, Superintendent of Transmission, Susquehanna Transmission Companies of Pennsylvania and Maryland, Baltimore, Md., U.S.A.; Dr. Friedrich Schraeder, Wasser-Gas-und Elektrizitats Werke, Mannheim, Germany; Major Koyo Moriya, Ordnance Inspector, Japanese Imperial Army; Frau A. and Fraulein Ursula Menge, wife and daughter of President, Elektro-Werke A.G., Berlin, Germany.

Several of the above gentlemen, being involved in gas distributing enterprises abroad, were exceptionally interested in modern American gas appliances and in the Association's research activities. Mr. Pacanins of Venezuela was representing his government which hopes to tap vast Venezuelan natural gas resources in the near future and is studying American Gas practice for guidance. Venezuela, according to Mr. Pacanins, has been second or third in world oil production for many years and has at its disposal large undeveloped gas fields. Yet Venezuela today cooks with charcoal. New gas systems to be laid, new wells to be sunk, and new appliances to be bought (largely from the United States) are expected, however, to alter the trend.

Mr. C. C. Hsiao of China also will return to his country with knowledge borrowed from American experience and will recommend to his governmental committee on Utilization of Natural Resources the best and the most desirable methods of bending China's enormous resources to human service. Mr. Hsiao is merely winding up three full years of special study in America with his visit to the laboratories and attendance at the Third World Power Conference. At Pennsylvania State College he was one of an army, 1500 strong, of Chinese students in America. He will return to serve, as before, in the Chinese Ministry of Industries under which the Geological Survey operates.

Group of delegates to World's Power Conference



ARTHUR HEWITT

Arthur Hewitt, President and General Manager of The Consumers' Gas Co. of Toronto, Canada, died September 17, 1936. He was born in Wolverhampton, England, sixty-eight years ago, leaving that city with his family to come to Toronto in 1881.

When Mr. Hewitt joined the company in 1887, the Consumers' Gas Company had 9,004 customers and the output of gas was considerably less than one million feet a day. Today there are 170,000 customers and they use more than 22,000,000 feet a day.

His progress after he joined the company as private secretary to the general manager was rapid. He proceeded through the accounting departments to the position of assistant to the general manager whom he succeeded in 1909.

The promotion of the use of gas in the home and in industry had in him an aggressive executive. The new business departments of the company had his strong support and his interest in Home Service work is well known to the industry. As an official and later as General Manager and President of the company, he was always zealous in cultivating good public relations.

The following quotation from a Toronto daily paper, on his appointment as President of the Company in November 1934, is a sample of the results of these particular efforts:

"An outstanding achievement of this company—for which much of the credit naturally belongs to the general manager—has been the winning of public goodwill unexcelled by other institutions. This goodwill has been the result, no doubt, of manufacturing an excellent product, of the training of employees to render the best possible service, and a policy of frankness in public relations."

Mr. Hewitt was elected president of the American Gas Association for a year in 1932, the first Canadian to hold that office. He was also a former president of the Canadian Gas Association.

★ *See you AGA Atlantic City Week Oct. 26 . . Booth 210*

McWANE CAST IRON 2" PIPE *for revenue producing*

Why not make those gas mains as permanent as your source of supply? McWane 2" gas pipe is laid only once. Resists corrosion. Requires no coddling. Lasts for centuries. Modern joints that stay bottle-tight no matter how much gas pressures are increased. L-o-n-g 18 feet laying lengths now with only one intermediate joint. Flexible! around curves without fittings. Over 20,000,000 feet in service! Yes, all sizes 1¼" thru 12"!

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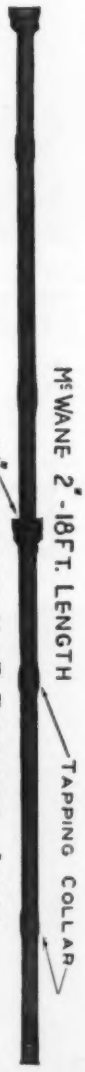
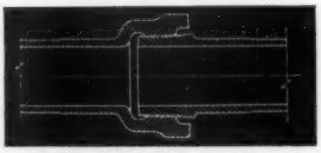
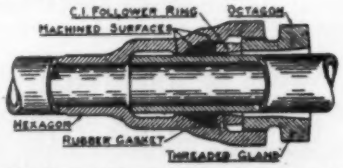


PERMANENT GAS *mains!*

McWANE Oversize M & F THREADED JOINT



The *one* joint as strong and permanent as the cast iron pipe itself. The *one* joint that stays *bottle-tight* under all pressures. Ask for list of satisfied users in your section.



McWANE GLANTITE MECHANICAL JOINT
Spaced at intervals in modern gas lines to take care of expansion and contraction. All Bell Glantite Fittings, too!

over 20,000,000 FEET IN USE

Southern Oregon Gas Enlarges Facilities

Work will commence within the next few days on the extension of two important mains in the Medford Area served by Southern Oregon Gas Corporation, J. A. Ward, President has announced. This will be followed by additional work in other areas served.

The consistent expansion program of the company has included a new office, sales and display building in Medford. This building, modern in every detail, is completely gas-equipped. Electrical generating plant, air-conditioning system, even display lighting are fueled by gas. Opened for inspection September 12, with appropriate ceremonies including a remote control radio broadcast, the new structure received the enthusiastic approval of the community.

Since reconstructing its plants to distribute Butane gas, Southern Oregon Gas Corporation has made five substantial rate reductions within two years. Latest reduction is a lowered heating rate for both commercial and residential consumption, effective September 1. During the current year gas consumption has increased over 1935 by 40%. The territory served by the utility includes Medford, Roseburg, Ashland and Grants Pass.

New Cutler-Hammer Plant at San Francisco, Cal.

Cutler-Hammer, Inc., manufacturers of electric control apparatus, Milwaukee, Wis., announce the extension of their manufacturing facilities to the West Coast. A new plant, at 970 Folsom Street, San Francisco, Cal., began operation in September.

Completely equipped with new machinery, this is the most modern switchboard plant on the West Coast, according to F. H. Oberschmidt, manager of Cutler-Hammer's Pacific Coast District.

New air view of American Meter Company's Metric Metal Works plant at Erie, Pennsylvania. This unit of American Meter Company occupies more than 170,500 square feet and employs over three hundred people. In the right foreground is the new brass and alloy foundry.

C. H. M. Burnham with J. G. White Eng. Corp.

Mr. C. H. M. Burnham has joined the J. G. White Engineering Corporation organization and is assigned to work for the Coast Exploration Company, Federal Reserve Bank Building in San Francisco. Prior to joining the White organization, Mr. Burnham served eleven years with the Cities Service Company, engaged in various phases of the natural gas industry, both in the mid-continent and Rocky Mountain areas. For the past three years, he has been resident in New York City.

Prior to joining the Cities Service Company, Mr. Burnham was engaged for a number of years as Construction Engineer for the Ohio Fuel Gas Company, now identified as the Columbus group of the Columbia Gas Electric Company's system.

WILLIAM W. BIRCH DIES

William W. Birch, Vice-President of The Stacey Manufacturing Company, Cincinnati, Ohio, died suddenly, October 1st, at his home.

Mr. Birch was born in Dayton, Ohio, 79 years ago; the son of Thomas H. Birch, one of the founders of The Stacey Manufacturing Company. He entered the services of the company at the age of 16 and remained with them continuously for a period of 63 years.

Although Mr. Birch had almost reached the four score mark, and during the past several years functioned in an advisory capacity only, he was extremely active and keenly interested in all recent developments.

Leeds & Northrup Co. Open New England Office

A New England office, staffed for consulting and sales engineering service to those having problems of instrumentation in manufacturing processes, laboratories, power plants or educational institutions, has been opened recently in Boston by Leeds & Northrup Company. The address is 80 Federal Street, Boston, Mass.

Karen Fladoes Appointed Home Service Director of Peoples Gas

The appointment of Miss Karen Fladoes, nationally known Home Service expert, to succeed Mrs. Anna J. Peterson as director of Home Service for the Peoples Gas Light Coke Co., Chicago, Ill., was announced by F. X. Mettenet, Vice-President in charge of sales. Miss Fladoes left her position with the Equitable Gas Company of Pittsburgh to join the Peoples Gas family as of the 15th of August.

Mrs. Peterson, although confined to her home in Elgin by illness, will act as advisor to the new Home Service director.

Miss Fladoes goes to Peoples Gas at the height of a conspicuously successful career in the field of Home Economics. A graduate of Stout Institute, she did post-graduate work at Columbia University and then spent four years with the Washburn Crosby company as organizer of cooking schools.

Karen Fladoes who will be Martha Holmes to Chicago's costumers

European Officials Visit American Plant

For the purpose of gaining first-hand information regarding latest developments in American operations, particularly in the gas and petroleum fields, several European officials representing the products of the Merco Nordstrom Valve Company and Pittsburgh Equitable Meter Company have visited the United States. Anthony Bruyaux of Brussels, Belgium, recently arrived from Europe, accompanied by Kenneth M. Leach, son of the managing director of the Audley Engineering Company, Ltd., of Newport, Shropshire, England, and F. Appleyard, research and development engineer for the same company.

Messrs. Leach and Appleyard are active in the engineering and sales department divisions of the Audley organization. This company is the manufacturing licensee for Nordstrom Lubricated Plug Valves which are marketed in England and on the continent under the trade name "Audco."

Mr. Bruyaux is the European representative for the two American companies. He has just concluded inspection of a number of gas plants and production fields on his American visit. Returning to the Continent, he expects to be joined by Colonel W. F. Rockwell, president of the American concerns, who will fly there on the Hindenburg this fall. Mr. Bruyaux accompanied Colonel Rockwell to the recent convention of the Pacific Gas Association in San Francisco.

Anthony Bruyaux and Col. W. F. Rockwell

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TO ASSURE
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Byllesby Organization Changes Name

The board of directors of Byllesby Engineering and Management Corporation today voted to change the name of the organization to Public Utility Service Corporation, and elected B. W. Lynch as president of the new corporation succeeding John J. O'Brien, formerly president of Byllesby Engineering and Management Corporation, who died on August 7. Mr. Lynch is also president of Standard Gas and Electric Company.

Byllesby Engineering and Management Corporation was organized in 1919, to render engineering and managerial services to public utility and other companies but particularly for those companies comprising the Standard Gas and Electric Company system. In September, 1935, the stock of the management corporation was sold without profit to these companies by Standard Gas and Electric Company and the corporation then functioned as a service organization on a cost basis to the companies acquiring it. The purpose of the change in name from Byllesby Engineering and Management Corporation to Public Utility Service Corporation is to more clearly indicate existence of Public Utility Service Corporation as a separate and distinct organization from H. M. Byllesby and Company, the investment banking house.

Members of the board of directors of Public Utility Service Corporation consist of the presidents of the operating companies (who were elected at the time these companies acquired Byllesby Engineering and Management Corporation last year) as follows: F. R. Phillips, president, Philadelphia Company, Pittsburgh; R. F. Pack, president, Northern States Power Company, Minneapolis; J. F. Owens, president, Oklahoma Gas and Electric Company, Oklahoma City; T. B. Wilson, president, Louisville Gas and Electric Company, Louisville; J. P. Pulliam, president, Wisconsin Public Service Corporation, Milwaukee; C. M. Brewer, president, the California Oregon Power Company and Mountain States Power Company, Medford, Oregon; W. F. Raber, president, San Diego Consolidated Gas and Electric Company, San Diego; W. N. Clark, president, Southern Colorado Power Company, Pueblo; and B. W. Lynch, R. J. Graf, M. A. Morrison and H. C. Cummins, all of Chicago.

Pressure Regulation

(Continued from page 38)

valves. Just what magnitude the loss across soft valves can be depends on the nature of the gas. However, many successful installations permit more than a seventy-five pound cut.

The question of regulator freezing has been a serious one in recent years. The use of higher pressure in transmission and distribution, meaning larger pressure cuts at regulators and particularly the extension of high pressure natural gas lines into areas of lower atmospheric temperatures, have brought out many instances of ice formation at the valves preventing the proper functioning of the regulators.

It is a well known fact that the expansion of gas through a throttling process is accompanied by a temperature reduction of the gas. We find if we balance the heat energy equation of a given amount of gas before it is expanded with the heat energy equation after it is expanded that there is absorbed a certain amount of energy in speeding the gas up through a throttling range and in changing the gas to its expanded state after throttling. This energy loss can only be made up by withdrawing heat from itself, which results in a reduced temperature. In pure theory this temperature reduction is oftentimes very extreme. Actually friction of the gas with the containing walls and particularly internal friction due to turbulence of the gas, restores part of the lost temperature. Because it is almost impossible to calculate the restoration of temperature due to turbulence, it is almost impossible to predict the temperature the gas will have after passing the regulator valves. If the temperature is low enough, certain vapors will condense out in the form of liquids, water vapor among them. There are also evidences of gas hydrates solidifying at temperatures as high as 45° at a pressure of 300 pounds per square inch. Ice formed at 32° and hydrates formed at somewhat higher temperatures often times will pile against the valve seats and interfere with proper functioning of the regulator. There are several remedies for this.

First, arrange the pressure cuts in making the reduction so that no one cut in itself will produce a temperature below the point where the hydrates form and provide sufficient space between the outlet of one regulator and inlet of the next so that the gas of itself will restore some of its temperature. Another method is to actually preheat the gas before it goes through the expansion process so that its temperature after expansion is still higher than that at which the hydrates or water will solidify. This preheating is quite common practice. The gas itself is used as a fuel and the heat transfer is either by direct contact of the products in combustion with the pipe line or by means of heating water which is then led into contact with the pipe line.

Another method is to heat the regulator in some way so as to keep the valves and their parts at a temperature higher than that at which the hydrates or ice will form. This is sometimes very inconvenient and in some instances it is impossible to get enough heat units to the valves in this manner to prevent the formation of ice. Another way which is finding favor in the last few years is to actually electrically heat the valves themselves. Even though the temperature of the gas is reduced by its expansion to the point where hydrates and ice form, if the valves are maintained at a sufficiently high temperature, these hydrates or ice will not condense on the valve parts. Figure IX shows a typical electrically heated valve structure.

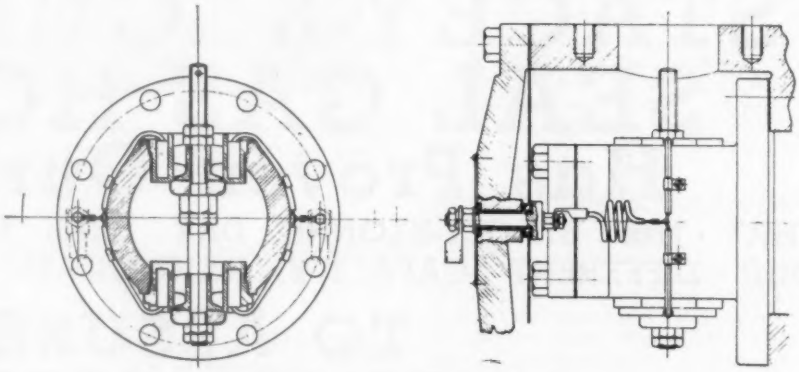

Fig. IX.—Electrically Heated Inlet Bowl.

None of the methods above can be said to be effective in all cases and they are to a certain extent wasteful. However, the physical fact is present and heat must be added to counteract the loss of temperature caused by expansion.

What we have said above is mainly true of transmission line, city gate and high pressures regulators where the pressure reduction is from pounds to pounds. One of the very familiar applications of big regulators is in the standard distribution system of a gas company where high pressure lines are run to most parts of the city and at certain points cut down to pressures expressed in inches of water and through mains led directly into the consumers premises. Figure X is typical regulator as used in the district governor work. It will be noted that there is a very large flexible diaphragm since the pressure under it is only inches of water, and a leverage is provided between the diaphragm and the valve. This will insure very accurate control because very small changes in valve position can be effected even though the diaphragm may travel through quite a space. Also the

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leverage and large diaphragm will insure accurate and positive shut off when the regulator is called upon to cut off the flow. It is obvious for this type of service that this regulator must not only control pressure very accurately within a range expressed in tenths inch of water, but also must effect a complete shut off at low flow or zero flow hours to prevent building up of an unsatisfactory or dangerous pressure on consumers service lines. The valves of this regulator must be of the soft type to insure this positive locking off of pressure and the adjustments of the two valves must be carefully made to insure proper control.

The control line that leads the pressure to the control chamber under the diaphragm head can be led to a point directly at the outlet of the regulator or to a point a considerable distance downstream. It can also be used in so-called "around the block" control, in which the control chamber is connected to a point within perhaps a block's distance which, by means of partially closed valve is made to simulate some low pressure point in the system.

Like any other piece of mechanical equipment, for transmission and distribution regulators some inspection and maintenance procedure must be maintained. The silent watchman over regulator performance is the daily or weekly pressure chart. Any gas system having a sufficient number of recording pressure gauges located at strategic places in the high, medium and low pressure systems can quite readily detect a gradual tendency of anv particular regulator toward a condition of poor performance. A regular routine in chart collection, and especially in chart inspection, is a long step in the direction of good regulation maintenance.

Who should be made responsible for regulator maintenance varies with different utility companies. In general, the superintendent of distribution has the responsibility of maintaining satisfactory performance of regulators, and charts should come to his attention, in addition to the attention of other members of the distribution department. Since pressure charts make such a good yardstick with which to measure regulator performance, the person responsible for this performance should insist on careful setting of charts, standard routine in collecting, marking (for date and location), inspection, and filing. As a part of this routine, periodic testing of the actual recording pressure gauge by means of test gauges or dead weight gauge testers should be made to be certain true pressures are being recorded.

The man who operates the gas system in Utopia will have his regulators so arranged that he has just enough pressure to serve every consumer during the heaviest peak load, but not a bit more. This Utopian operator is, of course, a model for all of us, and our setting and maintenance of regulators should be directed to this end. To accomplish this the regulator must be regularly inspected, repaired and tested. Each system, due to local peculiarities, will eventually devolve a method best suited for its own particular needs, and the following are merely suggestions to be considered in arriving at a good maintenance procedure.

(Continued in November issue)

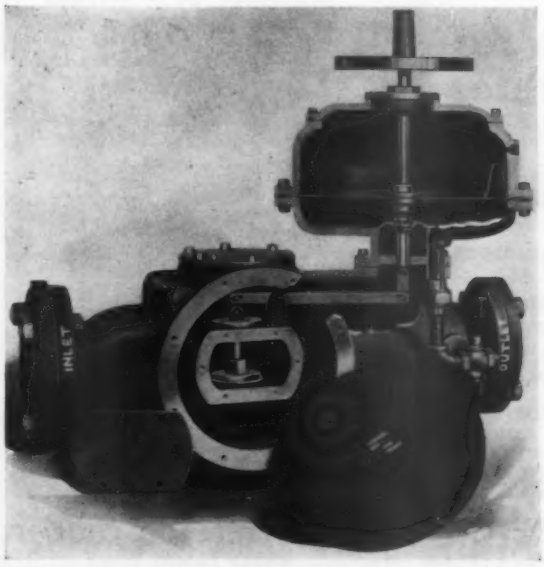

Fig. X.—Low Pressure Balanced Valve Regulator.

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Selling Gas for Industrial Heating

(Continued from page 28)

mend smaller units so that on low production one or more units are shut down and the others operated at near designed rating.

During the depression, the furnace manufacturers have been trying to build furnaces to reduce operating costs. With one shift operation vs. three shifts, the thermal capacity of a furnace was a big factor. Combination insulating refractory bricks used as furnace wall material in place of firebrick reduced the time and fuel required to heat up the furnace by as much as one third. In an attempt to give continuous carburizing without the use of containers, the Surface Combustion Co. produced the Eutectrol furnace for case hardening. This has revolutionized carburizing on certain products and materially reduced former costs.

Forging practice has been improved through the use of diffusion burners for certain types of work.

The advent of bright annealing has brought about the development of the various types of hot tube furnaces.

Machines for producing protective gases for the tube furnaces have been perfected.

During this same time the ceramic field has been actively developed by the gas industry. Continuous gas fired kilns have replaced many coal fired beehive kilns. These have had to be sold after careful study, full use of insulation, preheating of ware from exhaust gases, preheating air for combustion by cooling outgoing ware and the further use of waste gases for drying ware.

Our customer now says that the change-over from coal to gas, and from periodic or "beehive" kilns to a Glost Tunnel Kiln, has accomplished a 54.4% reduction in the heat requirements per unit of product fired, which reduction has been accomplished mainly as follows:

A A reduction in the ratio of gross to net weight of product occasioned by the elimination of saggers and the substitution of open placing racks.

B A natural recuperation due to the counter-current movement of goods and combustion gases in the preheating of the ware which means a much lower temperature of combustion gases leaving the kiln than prevails in the older beehive kiln.

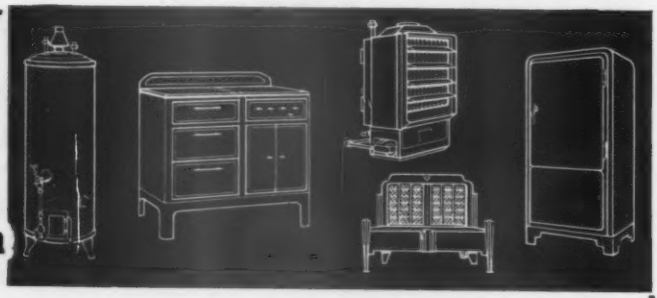
C The elimination of heat requirements to heat a large amount of brickwork each time the goods are heated which is necessary with periodic or batch operations, but unnecessary with continuous operations.

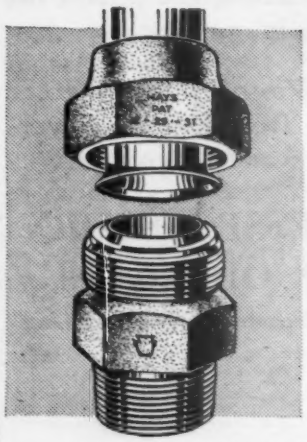
In addition to the above saving in heat requirements there is a very substantial part of the sensible heat left in the ware and the furniture at the end of the burner zone which is recovered through a waste heat recovery system surrounding the goods as they are cooled down in the kiln. This waste heat is distributed through the plant for drying and general heating purposes. There is also a lowered labor expense of operating both in the loading and firing and unloading, and a lowered maintenance expense on containers due to a change in design from an integral shape, such as saggers, to a built-up rack of five parts, any part of which can be replaced when needed without discarding the entire sagger as was formerly done.

The gas fired hot tube furnace has well established itself in the vitreous enamel field and will be in use in at least two decorating china kilns before many months.

In conclusion, may I suggest that if you have not made a survey of your potential and existing gas market, do so. Close the easy ones first so as to immediately increase your sales. Make detail studies on the harder prospects. Prepare a typed report breaking down costs and present it in such an enthusiastic, clear, honest manner that your prospect will want to use gas.

Hook Them Up This Modern Way





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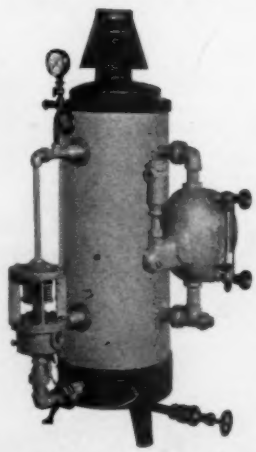

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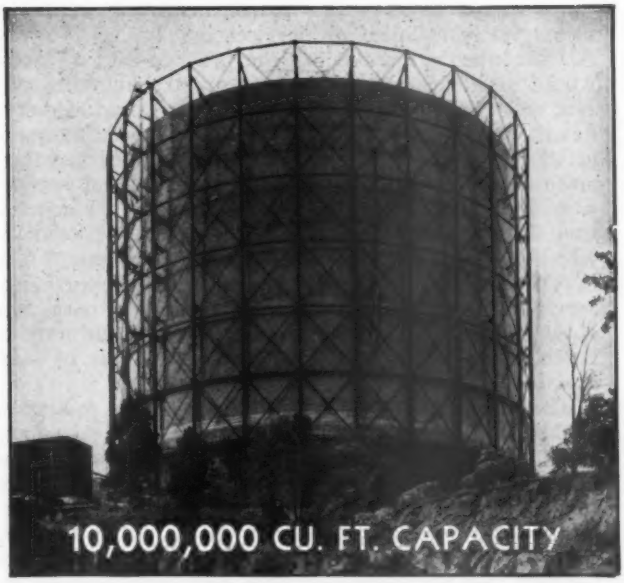

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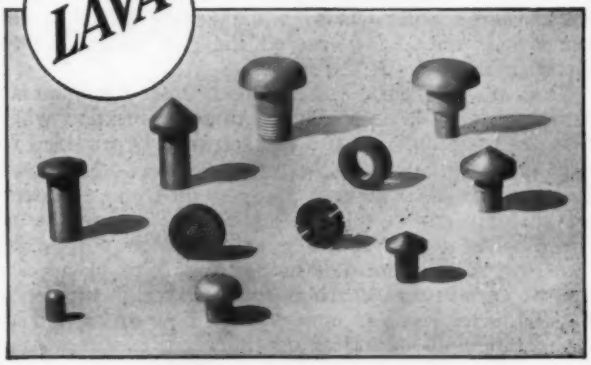

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Pipe Corrosion and Coatings

(Continued from page 32)

Mitigating Stray Current Effects

Methods have been developed to prevent the major percentage of leakage from electrical systems; but actual installation of such methods has been slow because there are few statutes compelling those who generate and distribute electricity to provide against the potential damage which such leakage may produce. When considering only the electric transmission and distribution system, economy does not warrant the additional investment required to install leakage prevention apparatus unless the leakage is of larger volume than occurs on the average system. Since the utilities which operate sub-surface structures cannot attack the problem of the source, they must resort to some means of lessening the corrosiveness of the stray currents.

Only two general methods are generally available for mitigating the effect of stray currents. In many communities co-operative efforts have been instituted by operators of structures affected by leakage currents and those controlling the source of such currents. The primary purpose of such co-operation is the determination of the major source of the stray currents, if possible, but particularly to locate where such currents enter a system. Following determination of the source, eliminating or minimizing the amount of the current entering a system is comparatively easy. The second method is for every operator of sub-surface structures to safeguard his own apparatus against the effect of currents and to prevent the transmission of such currents by his system by means of various insulating, grounding or protective methods. The disadvantage of the first method at present is that once a current has been traced to its actual source, elimination of the leakage remains only a moral obligation on the part of the producers. Practically nothing can actually be done by the utility affected by stray current electrolysis to eliminate sources of leakage. Therefore the major activity must be the installation of methods to minimize the effect of currents once they have entered the gas system, or the electrical isolation of the system.

Once a current has been imposed upon a sub-surface structure it must be conducted to some location where discharge is facilitated and can be properly provided for or confined to an area where the structure has a lower electrical potential than the surrounding soil or nearby metallic structures. Electrical insulation may be secured by the use of especially designed pipe joints which interrupt the current flow along a main, or by application of certain pipe coatings to the exterior surface of the conductor so as to interrupt the flow of current between pipe and ground or other structure.

Insulating Joints

Inserting an insulating joint on each service near the main is a common practice where trouble is experienced from stray current eletrolysis. The reason generally given is the more numerous failures of services compared with mains. However, while the total number of failures may be greater on services, it may well be due to the thinner walls of the service pipes, unless, of course, extra heavy pipe is used for services and standard weight for mains. Locating the insulating joint near the main results from the theory that the current causing failure originates elsewhere than near the areas of failure. It is presumed to be conducted by the mains to the services where discharge occurs. The stray currents originating in each consumer's premises are individually of insufficient intensity to cause corrosion. For this reason insulating joints are usually only installed on services in "hot spot" areas. An advantage of extending the practice into all areas would be the elimination of the main conducting current collected by numerous services. It would also confine damage to the service somewhere between the point at which the current enters in the interior of buildings and the insulating joint. Damage to individual services would soon be discovered and minimized by the installation of additional insulating joints near the point at which the service enters a building if necessary. The lower intensity of current on the greater proportion of services would also decrease the rate of corrosion. However, a decision to insulate services should only be reached after definitely establishing the value of such practice by field surveys.

The location of insulating joints in mains raises the problem of the most beneficial location. A field survey should indicate the major source and direction of the currents. Frequently insulating joints near the source of the current would minimize effects providing other structures did not by-pass or convey the current around such joints. In such instances the potential difference between two paralleling metallic structures may be increased beyond the insulating joint, thus facilitating the transfer of current from the uninsulated to the insulated structure, partially defeating the advantage of insulation. However, with such by-passing causing a partial dissipation of the stray current, the quantity flowing on the insulated section would be less than were no insulating joints installed, although intensified but highly localized action may occur were the current of sufficient intensity to arc between the two structures. The use of insulating joints is more common on services, although frequently used on mains when the source may be traced to one, or at most, a few major sources. Bonding all structures confines efforts at mitigation to localized "hot spots".

When disconnecting insulating joints, care should be taken to first install an electrically continuous conductor around the joint to prevent arcing should the current be of sufficient intensity to jump the space between the butt ends of the pipe or should tools accidently span the gap after the joint has been removed.

While certain types of ordinary joints may offer a greater resistance to current travel than others, they should not be relied upon for insulating a section, unless redesigned. Many regular main joints, offering high resistance to current flow when initially installed, gradually lose their insulating value.

The use of insulating joints may be only partially effective where the surrounding soil is capable of conducting the current from the side of high to that of low potential. A periodic current survey on both sides of insulating joints is valuable in determining the continued efficacy of the joint. It is desirable to assure the continued satisfactory functioning of any apparatus by occasional inspection even though the equipment is buried.

Insulating Coatings

The practical success of a coating applied to the exterior of a conductor depends upon its di-electric strength or resistance to the conducting of electrical current and the perfection with which it covers the surface. Both of these factors may alter with time. This will be more thoroughly discussed under the requirements of coatings.

In both collecting and discharging areas the di-electric strength of a coating must always exceed the po-

(Continued on page 110)

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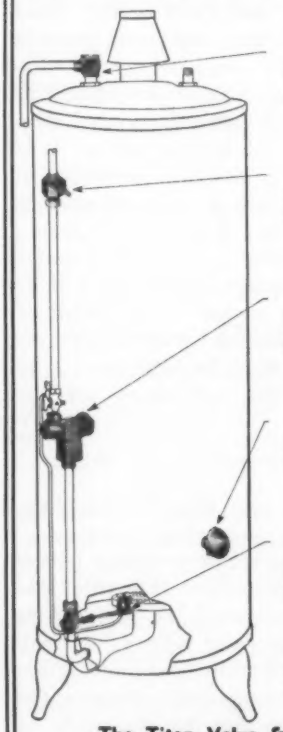

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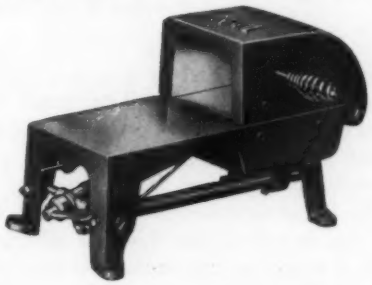

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tential difference between a conductor and adjacent structures or surrounding soil. Otherwise, there may be a minute rupture in the coating, followed by a concentrated current flow at the point of rupture due to a decreased electrical resistance. Coatings are available, having an electrical resistance considerably in excess of that required on any sub-surface structure, providing the continuity of the coating is maintained. The cost of the coating would ordinarily exceed that of insulating joints, but in the majority of instances the coating would be more effective. Some utilities follow the practice of not coating where corrosive currents can not be avoided, as a break in the coating would concentrate the effect of electrolysis in a small area and result in rapid penetration. However, for every one such highly localized situation there would be many in which the coating would prevent damage; and no coating may extend the damage over a considerable area. In most instances the choice is between highly localized, easily detected penetration in a shorter time, or numerous penetrations, each of a possibly smaller size over a large area, but more extended time. The failure of uninsulated pipe may be delayed beyond the period in which the responsibility remains with the person making a decision, but the eventual result is inevitable and its minimizing a moral obligation when realized. Also rapid failures in a main at faults in a coating once repaired are practically never repeated, as a small repair is considerably less likely to be defective than an initial extensive section of main. Repairs are usually more easily made in the early years of the existence of a main than following permanent roadway improvements. The areas in which electrical currents are collected are ordinarily more extensive than those in which discharge occurs. Therefore, the possibility of defects existing in discharging is less than in collecting areas. Using this trend of thought there is a further insurance against damage by the use of insulating coatings.

Shielding

Another insulating method is the installation of a metal shield surrounding part or all the main at a localized point where arcing may occur or a current be traveling from some other structure to be protected. The shield consists of a pipe, larger in size, than the one protected. Thickness is advantageous in lengthening the time during which the shield is effective. The shield acts as a receiving agent for concentrated high intensity currents and is itself damaged or dissipates the current over a large area, thus decreasing the effect. The shield may be grounded or electrically connected to the main. More commonly it is separated from it by materials, such as dry sand, which offer a high resistance to the current; and the shield grounded at some point sufficiently removed from the protected structure to prevent a current being carried to the protected structure. This type of shield is frequently installed where sub-surface structures intersect and are separated by only a small distance. In city conditions shielding is frequently difficult due to space restrictions.

The use of sand between shields and mains is an adaption of an old practice of backfilling around mains with sand in "hot spots". The sand being a poor conductor decreases the amount of current discharge and its fineness provides an evenness of contact over the surface resulting in a uniform discharge.

A bare metal main which inspection and survey indicate as having more or less rapid deterioration from electrolysis may advantageously have electrical grounds installed at or just previous to areas of current discharge. A heavy stranded copper cable is soldered to the main, care being exercised to provide a good contact, and led as far from the main as practicable. It is then connected to a large mass of metal or imbedded in grounding material, such as carbon or coke screenings. The ground may be old steel, cast iron or other metal. The ground should be buried below the ground water level, if possible, and if not, where conditions will be most favorable for discharging current. The metal of the ground will be rapidly eroded and may require replacement periodically. This may be determined by measuring the current flow and computing loss or occasional inspection.

Electrical Measurements

To determine the need for and value of bonding, grounding, cathodic protection and other current deflecting methods, testing stations for determining potential drops of current flows are valuable. Potential stations must have leads welded, brazed, or soldered to the main and conducted to some point where they may be conveniently attached to potential indicators or recorders. The exact distance between main contacts, the cross sectional area of the main and the resistance of the main metal must be known. From these data, plus potential readings, current flow may be computed. The direction of potential drop is important, and therefore an instrument indicating both ways from zero is necessary, or else leads must be changed if deflection is minus.

Where insulating joints exist, current readings may be taken direct by the contacts being connected to both sides and leads run direct to an ammeter. The ammeter must have a wide range and preferably be wired so that the readings have three separate factors, depending on which particular resistances are cut in.

Fully as important as the potential drop or current flow along a main is the relative potential difference between a main, the soil and other structures in the immediate vicinity. Should the electrical pressure or potential in a main exceed that of the surrounding soil or other structures, an important element in producing a current flow exists and is completed when a conductor exists. A potential drop between structures or between soil and structures is not proof that a current will flow, as the intervening medium may offer a greater resistance than the electrical pressure can surmount. However, the conductance of material surrounding a main alters considerably especially with moisture content. The potential difference between structures may therefore cause a flow of current only part time which would lengthen the period before failure due to loss of metal being intermittent.

The numerous factors involved, together with variations of intensity, precludes establishment of practices to guard against electrolysis for the universal guidance of main laying crews. Where conditions are severe an engineer specializing in electrolysis and corrosion control is an economy, and his personal attention is required

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in deciding on the methods to be followed in any designated area. If an installation is made in an un-zoned area, personal inspection of each case is necessary. The establishment of zones or routine procedures, such as insulating joints on every service, should not be considered final, but research should be periodically conducted to determine the value of any plan.

The scope of electrolysis requires keen observation, clear comprehension and a technical training.

(Continued in November issue)

Internal Treatment of Mains As a Leakage Deterrent

(Continued from page 56)

(b) porous castings
(c) undetected service leaks and
(d) stealing

No detailed tests have been made on this entire area since January, 1936. However, tests on two isolated streets in the area late in 1935 showed the following results:

Street A. 476 ft. of 4-inch cast iron pipe with lead joints installed about 1907.

Initial leakage, April, 1934, 7 cu. ft. per hr.
Leakage after first treatment, April, 1934, 1 cu. ft. per hr.
Leakage, October, 1935, 2.5 cu. ft. per hr.
Leakage after second treatment, November, 1935, .15 cu. ft. per hr.

Street B. 360 ft. of 3-inch cast iron pipe with lead joints.
Initial leakage, April, 1934, 6.1 cu. ft. per hr.
Leakage after first treatment, April, 1934, 1.1 cu. ft. per hr.
Leakage, October, 1935, .7 cu. ft. per hr.

Conclusions

Leakage in bell and spigot joints may be due to a variety of causes, including defective joints, and complete loss of packing material. By far the most important cause, however, is the large shrinkage in volume of the jute packing which occurs on dehydration.

For this condition both laboratory and field studies show that Carboseal is an effective remedy. It combines the climbing mobility and swelling power of water with low volatility and hence is relatively permanent in its effects.

It is believed that the beneficial results sometimes accomplished by continuous hydration or oil fogging systems can be achieved in most cases more positively, and at a lower final cost by Carboseal.

Exhaustive laboratory studies have shown that no other combinations of liquid chemicals are capable of rendering an equivalent degree of protection at as low a cost.

The particular properties which make Carboseal of unique value for restoring dehydrated jute packings to their original gas tight condition are as follows.

Properties of Carboseal

Carboseal is a stable, mobile, non-volatile, non-inflammable, hygroscopic liquid having specific rust and gum inhibiting properties. It is strongly adsorbed and retained on the cellulose fibers of the packing yarn. Saturation of desiccated jute by Carboseal results in a volume increase equivalent to water saturation or about 44%, and tends to restore to the desiccated fibers their initial elasticity and tensile strength. Carboseal cuts and penetrates tars and gum deposits. Hence its exceptional "wetting out" properties and speed of climb in the jute packing material is not seriously interfered with by the ordinary tar and gum deposits usually found in the older distribution systems*. Carboseal is also a powerful fungicide and preservative, preventing rot. Its odor is slight and inoffensive. It has a slightly irritating action upon some skins, which can be relieved by rinsing with rubbing alcohol, or a dilute solution of baking soda. Taken internally it is a poison. Carboseal weighs 9.32 pounds per gallon at 60° F.

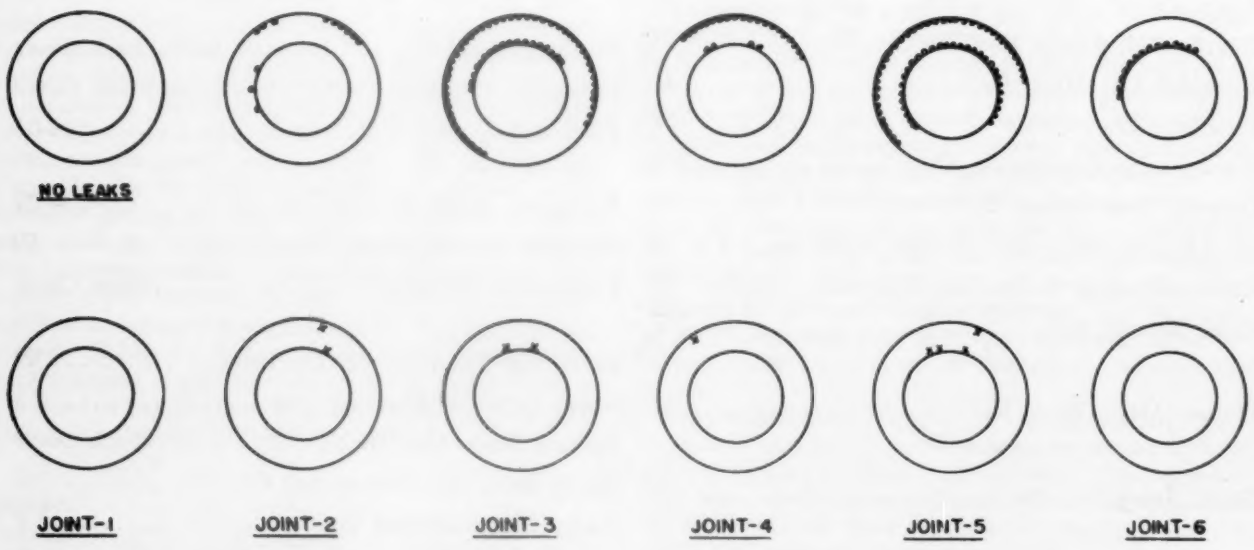

Exhibit 4

* *Excessively hard gum deposits constitute an exception.*

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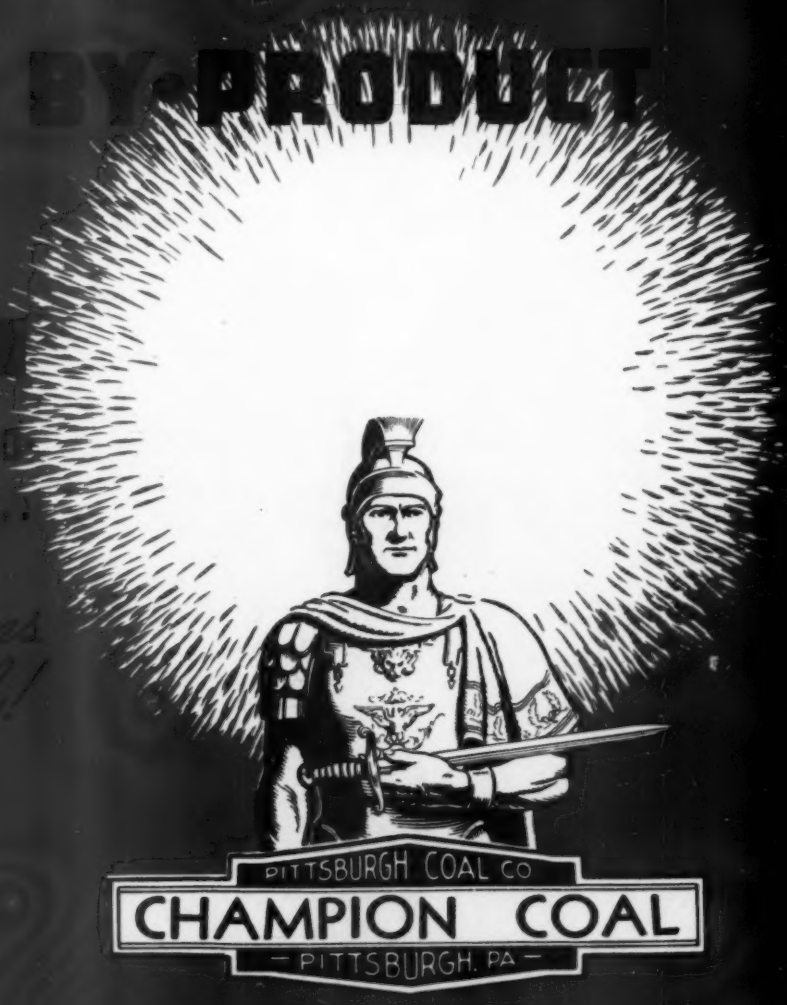

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